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GROWTH IN UNDERSTANDING OF GEOGRAPHIC TERMS IN GRADES IV TO VII

BY

T. J. ESKRIDGE, JR.



DUKE UNIVERSITY PRESS
Durham, N. C.
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GROWTH IN UNDERSTANDING
OF GEOGRAPHIC TERMS
IN GRADES IV TO VII

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FOREWORD

Perhaps no more serious danger confronts the teacher of the social studies than that of accepting purely verbal statements as evidence of sound learning. The danger lies in the fact that such statements may represent no more than the mastery of words and phrases which have been identified by the learner as the appropriate responses to make in given situations. However accurate these verbalizations may seem to be, they may be almost wholly devoid of real meaning and significance so far as the child is concerned. The product of this kind of learning need not be imagined, for it is directly observable in the "knowledge" which school children acquire in their "study" of geography, history, and civics.

These facts and this danger have been known for years. Nevertheless, exceedingly little research has been done with a view to determining the extent and nature of this empty verbal learning, or, stated in positive terms, with a view to determining how children may be led to develop rich meanings for the terms and concepts which they encounter in the social studies. It is precisely this problem which Dr. Eskridge undertook to investigate. In the research reported in this monograph Dr. Eskridge attempted to trace the growth of meaning for certain important geographic terms through four school grades and to isolate the factors which condition such growth and the principles according to which the growth takes place.

The study as here reported is substantially that made by Dr. Eskridge in order to fulfill in part the requirements for the degree of Doctor of Philosophy. Minor changes have been made in the organization of Chapter III; new data have been included in Chapter IV; and the extensive statistical data in the appendix of the thesis have been omitted.

WILLIAM A. BROWNELL.

ACKNOWLEDGMENTS

In presenting this thesis the writer wishes to acknowledge his indebtedness to all of those who have contributed to it in any way. He is especially obligated to Dr. W. A. Brownell for suggesting the problem, for helpful advice, and for general supervision of the work; to Dr. Howard Easley for reading the manuscript and for many helpful suggestions; to Mr. W. E. Black, Superintendent, and to Mr. R. E. Seymour, Mr. J. R. Hooten, Miss Ruth Cooner, and Miss Nannie Major, Principals, of the Greenwood, S. C., Public Schools for permission to give the tests; to the teachers in whose classes the tests were given, for their co-operation throughout the study; to the pupils who took the tests; to the students in the Department of Education of Lander College who assisted in giving and scoring the tests; and finally to his wife, Irene Holland Eskridge, through whose encouragement and personal sacrifice it was possible to complete this study.

T. J. ESKRIDGE, JR.

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GROWTH IN UNDERSTANDING
OF GEOGRAPHIC TERMS
IN GRADES IV TO VII

CHAPTER I

THE PROBLEM

APPROACH

WHAT CHILDREN'S WRITTEN WORK REVEALS

"A volcano is something that looks like a tater bank and when it gets hot it busts." So wrote a seventh-grade boy in response to the question, "What is a volcano?"¹

And not just one, but several seventh-grade pupils defined *prevailing* winds as "kinds which come from the west. They are very strong winds," or wrote similar statements when asked the meaning of the term.

Of the fifty children in grades four, five, six, and seven who were asked, "What is meant by the mouth of a river?," thirteen, or almost 30 per cent, wrote, "The mouth of a river is the place where the river starts."²

How shall answers such as these be treated? Shall they be dismissed lightly with a shrug of the shoulders and the observation that some children are just naturally dull? Or, is it possible that these answers have a significance which is not immediately apparent but which if studied will result in a better understanding of the mental processes of children?

In the case of the youngster who said that a volcano was something that looked like a potato bank, shall one say that he probably knew as well as anyone else what a volcano was but that he was just unable to express himself clearly? Or, does it seem reasonable to suppose that perhaps the pictures which he had seen of volcanoes had somehow given him the idea that volcanoes were piles of dirt, of the same general size and shape of potato banks, which, for reasons which he did not understand, sometimes got hot and exploded? Perhaps, after all, this youngster did express himself very accurately even though ungrammatically. Who knows?

And what shall be said of the pupils who wrote that *prevailing winds* mean winds which blow from the west? Shall one say that they must not have prepared their lessons carefully and thus dismiss

¹ Reported to the writer by the teacher in whose classroom the incident occurred. The language is reproduced as accurately as possible.

² The example quoted is from the fourth grade. The other twelve answers were expressed in various ways.

the whole matter? The fact that such a large percentage of the children had got the idea that *prevailing winds* were winds which blow from the north, east, south, or west, or from some other direction would seem to indicate that these meanings of *prevailing winds* were not the product of chance factors or of careless study, but were rather the product of some special factor or set of factors. Perhaps children infer meanings in ways of which most adults are unaware. There is reason for thinking that such is the case.

And what shall be said of those children who wrote, "The mouth of a river is the place where the river starts"? One obvious explanation is that they were confusing the *mouth* of a river with its *source*. In some cases this explanation may be the correct one, but in others it is not. There are children who know perfectly well that the *source* of a river is the place where the river has its origin, that the *mouth* is the place where the river empties into another body of water, and yet who persist in saying that the *mouth* of the river is the place where the river *starts*. In the case of these children *mouth* and *source* are not confused. For them *starts* expresses a relationship quite foreign to the one expressed in the clause *has its origin*.

WHAT CONVERSATIONS WITH CHILDREN REVEAL

To one who has talked with children in a simple and informal way about the things which they have learned, it is evident that many have incorrect and oftentimes distorted ideas which seem to be unknown to their teachers. It is evident also that adults often read into the answers of children meanings which do not exist for the children at all. A few examples will make these points clear.

A sixth-grade pupil was asked if he knew what was meant by *altitude*. "Yes," he said, "altitude means how high up in the air a thing is." This answer, while not a perfect one, was no doubt sufficiently accurate to serve the ordinary purposes of the classroom. The first question was, however, followed by a second one, "Does Greenwood [the local city] have altitude?," and the answer was, "No! Greenwood is not *up in the air*."

When asked to identify the *north pole* on a standard 12-inch globe most children located it with what seemed at first to be a high degree of accuracy. Questioning, however, brought out very plainly the fact that a large proportion of the children were not thinking of the north pole as the point where the meridians meet. For some the *north pole* meant merely the general area around this point. For

others the *north pole* meant the portion of the earth which was encircled by the eightieth parallel.

A large proportion of the children also, perhaps influenced by maps presented in conjunction with magazine and newspaper accounts of Admiral Byrd and his south polar expedition, pointed to Antarctica when asked to identify the *south pole*.

Many other examples of a similar kind could be given to show that children often have queer and inexact ideas of the things about which they have studied. But more examples are not needed since enough have been given already to suggest that the meanings which children have for geographic terms is a fertile area for investigation.

PROBLEM STATED

The field of meanings is one which has many different aspects. In order to investigate this field, it is necessary to subdivide it into smaller ones, e. g., nature of meanings, development of meanings, complexity of meanings, etc., and to isolate particular problems which are connected with each of these smaller fields. This investigation relates to the growth of meanings. The particular problem which is investigated may be stated as follows: "How does growth in understanding of geographic terms proceed among the children of the elementary school, in grades four to seven?"

PREVIOUS INVESTIGATIONS IN THE FIELD OF GEOGRAPHY

So far as the writer is aware, there have been no investigations which have dealt with growth in understanding of terms in the field of geography. The *Thirty-Second Yearbook of the National Society for the Study of Education*, on the "Teaching of Geography," lists eighty-two studies which had been made up to and including 1932. Of these eighty-two studies, five relate specifically to problems of vocabulary. These five studies are those of Cunningham (6),* Kuene-man (9), Pease (12), Ridgley (13), and Shaffer (14). They will be reviewed briefly in the next section.

Among the studies reports of which are included in the *Yearbook* are six so-called minor contributions dealing with abilities, disabilities, and difficulties in geography. Two of these, those by Aitchison (1) and by Hart (8), pertain primarily to problems of vocabulary.

Two other investigations which relate specifically to problems of geographic vocabulary have been made by graduate students at the

* Numbers such as (6), (9), (12), etc., refer to the bibliography on p. 68.

University of Pittsburgh. These investigations were reported by French (7) and by Notz (11).

The *Education Index*, as of March 1, 1937, lists, so far as can be judged from the titles, only one investigation in the field of geographic vocabulary which has appeared since 1932. This study, made by Cole (5), is reviewed briefly in the following section, together with the vocabulary studies previously mentioned.

STUDIES REVIEWED

The studies of Aitchison, Cole, Cunningham, French, Hart, Kueneman, Notz, Pease, Ridgley, and Shaffer have nothing in common with the present investigation so far as their major purposes are concerned. They are presented here merely to indicate the nature of most of the work which has been done on the vocabulary of geography.

Aitchison. Aitchison (1) made a study of the misconceptions which 1,100 pupils, mainly in the sixth, seventh, and eighth grades, had of the *frigid, temperate, and torrid zones*. The pupils represented rural, small-town, and city schools of Iowa, Missouri, Montana, California, and Illinois. A multiple choice test consisting of five statements concerning each of the three zones was used to obtain reactions from the subjects. The data showed that the pupils had numerous misconceptions relating to the zones. Many of these misconceptions were attributed to the influence of the zone names.

Cole. Cole (5) derived a list of 1,008 geographic terms from an examination of six elementary geographies, the titles of which she does not report. From the original list of 1,008 terms, three classes of terms were deleted. The deleted words were "those occurring in the most frequent thousand of the Thorndike List, . . . those that did not occur five times in a book and in at least five of the six books," and those that were rated as "accessory or nonessential" by a majority of seventy-one elementary school teachers. The 228 terms which remained, Cole reports in her study. Many of these terms are names of products.

Cunningham. Cunningham (6) compared the vocabularies used in five representative geographies,³ in the content material which dealt with the United States.

³ The texts were:

a. Harlan H. Barrows and Edith Putnam, *Geography: United States and Canada* (New York: Silver, Burdett and Co., 1925).

b. Albert Perry Brigham and Charles T. McFarlane, *Essentials of Geography, First Book* (New York: American Book Co., 1925).

c. James Fairgrieve and Ernest Young, *The United States, Human Geography by Grades, Book Four*. (New York: D. Appleton and Co., 1925).

French. French (7) studied the "effect of practice exercises in reading on pupil achievement in geography." The specific training was in (1) vocabulary, (2) the reading of maps, graphs, and tables, and (3) the organization of subject matter. As a result of the investigation, it was found, with respect to each of the three functions studied, that specific training resulted in increased geographic attainment to a degree which was statistically reliable.

Hart. Hart (8) derived a list of fifty-five common errors in geography. The list included errors noticed in her own experience as well as errors reported to her in the course of the investigation. The errors were classified into five groups according to their nature and were submitted for examination to fifty-two persons experienced in supervising geography classes and in teaching geography teachers. Each of the fifty-two persons indicated the errors whose occurrence they had observed. The body of the study consisted of the classified list of errors with notations indicating the number of persons who had reported the occurrence of the errors.

Kueneman. Kueneman (9) studied the effect which a change in vocabulary has upon the ability of fourth-grade children to understand material selected from a geography textbook. She found that "the vocabulary changes do not affect the reading comprehension to a degree of difference which has statistical significance."

Notz. Notz (11) made a study of the vocabulary of fifth-grade geography. The aim of her investigation was "to analyze several geography texts and to derive a vocabulary of words and phrases necessary to develop the major understanding of each section or 'human use' region of the United States that will form a geographic understanding of United States as a whole, as a climax."

Such a vocabulary, consisting of 1,753 terms, was derived from an examination of four fifth-grade geography texts.⁴ The list of terms is presented as three vocabularies, designated as "common

d. Frank Morton McMurry and Almon Ernest Parkins, *Elementary Geography* (New York: The Macmillan Co., 1925).

e. Joseph Russell Smith, *Human Geography, Book One* (Philadelphia: John C. Winston Co., 1925).

⁴ The texts were:

a. Wallace Walter Atwood and Helen Goss Thomas, *The Americas: The Earth and Its People, Book Two* (Boston: Ginn and Co., 1929).

b. Harlan H. Barrows and Edith Putnam Parker, *Geography: United States and Canada* (New York: Silver, Burdett and Co., 1931).

c. Frederick Kenneth Branom and Helen Marie Ganey, *Geography of North America and South America* (New York: William H. Sadlier, Inc., 1931).

d. Richard Elwood Dodge and Earl Emmett Lackey, *Elementary Geography, Book One* (Chicago: Rand, McNally and Co., 1930).

words," "proper names," and "groups of words." A more extensive vocabulary of 4,546 words was also derived from the same texts. Both lists of terms were analyzed and compared with other vocabulary lists.

Pease. Pease (12) derived a list of 679 geographic terms which occurred in a "representative newspaper,"⁵ and in "news periodicals,"⁶ by sampling issues over a period of twelve years. The term *geographic* was interpreted very broadly; consequently, the list contains many words which are of a general rather than of a specific geographic nature. The first five words of the list are *abroad*, *acre*, *aeroplane*, *afternoon*, and *agriculture*.

Ridgley. Ridgley (13) derived a list of 1,200 selected place names from an examination of the second book of five series of geographies.

Shaffer. Shaffer (14) determined the frequencies with which words occurred in three world geographies⁷ by sampling every fifth line.

RELATED INVESTIGATIONS OUTSIDE THE FIELD OF GEOGRAPHY

There have been several investigations outside the field of geography which resemble the present one. For the most part the resemblance is in the type of testing-instrument used. Among the investigations referred to are those by Brownell (2), Burton (3), Meltzer (10), and Buswell and John (4).

BROWNELL

One of the most important investigations in the field of growth of meanings is that by Brownell (2). This investigation is a study of the development of children's number ideas in the primary grades. The procedure consisted in a careful analysis of the mental processes exhibited by individual pupils when they were dealing with various types of number material in actual classroom situations. The chief significance of Brownell's investigation, so far as the present study is concerned, is that it demonstrated to the writer how fruitful the genetic method of approach may be in arriving at an understanding

⁵ *The New York Times*.

⁶ *The Literary Digest*, *The World's Work*, and *The American Magazine*.

⁷ The texts were:

a. Albert Perry Brigham and Charles T. McFarlane, *Essentials of Geography, First Book* (Rev. Ed., New York: American Book Co., 1928).

b. Frank Morton McMurry and Almon Ernest Parkins, *Elementary Geography, First Book* (Rev. ed., New York: The Macmillan Co., 1928).

c. Joseph Russell Smith, *Human Geography, Book One* (Philadelphia: John C. Winston Co., 1925).

of the mental processes of children, and suggested the general nature of the attack to be made on the problem of this thesis.

BURTON⁸

Burton (3) made a study of children's civic information. In a series of seven studies extended over a period of eleven years, approximately 7,500 subjects were tested. Most of the subjects were sixth-grade children from schools located in California, Illinois, North Dakota, Ohio, and Oregon. The chief testing instrument was a multiple choice test of ninety-six items which had been constructed on the basis of results obtained from two preliminary tests. The ninety-six items were distributed equally among three groups classified as political, economic, and sociological. The subjects were told not to guess and were instructed to indicate their choice of alternatives by placing X in front of the one selected. Pre-tests were given to familiarize the subjects with the nature of the task expected of them. The following is a sample item taken from the test:

If a policeman finds a dead body, to whom does he turn it over?

The chief of police.

The coroner.

The health officer.

Burton's findings, presented here in an abbreviated form, were as follows:

1. At the sixth-grade level the best informed groups knew about 45 per cent of the information represented by the test; the least informed, about 25 per cent.
2. Pupil interest and maturity are such as to permit and demand the earlier introduction of direct civic instruction.
3. There was practically no variation in the *nature* of the civic information possessed by the several regional, economic, racial, or national groups examined.
4. There was considerable variation in the *amount* of civic information possessed by the several groups mentioned.
5. The acquisition of civic information at any given level and the growth in civic information taking place from grade to grade were not the result of any systematically organized instruction but largely the result of accidental contact, both in and out of school.
6. The boys were regularly and consistently superior to the girls throughout, for information studied.
7. There was no increase or marked change of any kind in the nature and amount of pupils' information over the ten-year period 1924-34.

⁸ Citations by courtesy of the author and the publisher.

8. The economic status of the home through its effect on cultural contacts and experiences was the factor most closely correlated with the amount of information possessed by groups of pupils.

9. The out-of-school contacts supplied a larger proportion of information than did the school.

10. The influence of the school increased steadily through the grade.

11. The chief factors necessary to acquisition of citizenship information would seem to be (a) a decent economic status which insures adequate and varied cultural contacts, and (b) systematic instruction in school. The school should in fact be so organized as to compensate for the underprivileged status of many pupils (3, pp. 304 and 305).

MELTZER⁹

The purpose of Meltzer's (10) investigation was, according to the author, "to trace the development in the minds of children of some concepts whose understanding make some important situations of contemporary life more intelligible to us." A list of 297 social, economic, and political concepts was determined from an examination of four books and of 112 issues of critical magazines spread over a period of five years. These terms were then weighted by means of a formula devised for the purpose in order to determine their relative importance. From this list of 297 concepts a list of thirty-one of the most important ones was selected for study.

Three hundred and thirty-three pupils from the fourth grade through the twelfth, in schools located in Bayonne, Passaic, and Jersey City, New Jersey, and in New York City were tested for an understanding of these terms by the personal interview method. The responses of these pupils were analyzed, and the frequencies with which basic or "core" ideas occurred were determined. Points were then assigned to each core idea, the number of points assigned depending on whether the ideas expressed had been adjudged superior, reasonably correct, etc. A total score for each pupil was obtained by adding the points assigned to the core ideas. The sum of the points earned constituted the total score.

The chief findings of Meltzer which are relevant to the present study are:

1. Children have a large number of core ideas or meanings for terms, the number varying from 101 in the case of *Personal Rights* to 34 in the case of *Foreign Trade*.

2. The core ideas have a wide range of worth. They vary from those at one extreme which are superior, through those of lesser merit, to those of the other extreme which are erroneous.

⁹ Citations by courtesy of the publisher.

3. Some terms are much better understood than others.

4. In general, there is a "steady development in the children's conceptions from grade to grade."

5. A positive correlation exists between "grasp of the concepts" and mental age.

BUSWELL-JOHN¹⁰

A fourth investigation which, from the viewpoint of procedure, is most related to the present one is that of Buswell and John (4). So far as specific aim and technique are concerned, this investigation, more nearly than those of Brownell, Burton, or Meltzer, resembles the present one. Because of the marked similarities and differences between the Buswell-John study and the present one, both in technique and in treatment of results, a rather full abstract of the plan of the Buswell-John study is given. This investigation had for its purpose the "study of the nature and the development of concepts of technical and semi-technical terms in the arithmetic of the first six grades."

A list of five hundred terms commonly used in arithmetic was collected through an examination of "all the vocabulary studies in arithmetic which could be found." From this list of five hundred terms a second list of one hundred terms was chosen for testing purposes. This list of one hundred terms was named the *selected list*.

Group tests covering the terms of the selected list were given to 1,500 pupils in Grades IV, V, and VI, and individual tests covering twenty-five terms (common to the selected list) and eight phrases were given to 240 pupils in Grades I to VI.

Four different group tests were used in the investigation. Test I was a multiple choice test which covered the one hundred terms of the selected list. The type of question included is illustrated by the following item from the test:

A rectangle is:

- () 1. A figure that is round like a ball.
- () 2. The answer to a division problem.
- () 3. A four-sided figure with square corners.
- () 4. A three-sided figure.

The pupils were required to indicate the correct meaning by placing a cross (X) within the parentheses preceding it.

Test I was divided into two equal parts, Form A and Form B, which were given on successive days to avoid fatigue on the part of the pupils.

¹⁰ Citations by courtesy of the authors and the publisher.

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"Tests II, III, and IV were shorter tests, each including only the first twenty-five terms of the one hundred terms in Test I. The purpose of using several tests instead of one was to determine whether or not a pupil who responded correctly in one test will do so in other tests."

Test II was a direction test. In this test the words were used in questions or in directions, and the responses of the pupils were interpreted as evidence of understanding or lack of understanding of the words. The following is a sample:*

Which of these squares is smaller?

Draw a ring around it.



Test III was a combination of the multiple choice and completion types. In this test the pupil was instructed to "choose the word that will make the sentence true and draw a line under it." The following is a sample item taken from the test:

To find how many books there are on a table we.....
the books.
sell count weigh buy

Test IV was a definition test. After each term there was a space in which the definition of the term was to be written. The following is a sample:

After each of these words write what the word means:
count.....

Both forms of Test I were given to 1,500 children, 500 from the second half of each of grades four, five, and six. Tests II, III, and IV were given to 300 of the same pupils, 100 from each grade.

The individual test consisted of questions about each of 25 terms and 8 phrases. This test was given to each of 240 children, 40 from each of the first six grades, who had previously taken a group intelligence test. The plan was as follows:

After each child had been taken to a place where there were no distractions and had been made to feel at ease, the examiner placed before him a typewritten list of the thirty-three terms and phrases which were to be used in this part of the study.

* The size of the squares shown in the sample item, and the position of the squares in relation to the printed matter differ from the corresponding items as found in the Buswell-John monograph.

"First, the entire list of terms was read to the child, and any terms which he had never heard before were crossed off the list. The remaining terms were then presented one at a time, the specific directions given to the child being 'Can you tell me what this word means in arithmetic?' The examiner made a verbatim record of what the child said. If the pupil hesitated too long or made irrelevant statements about a term, certain follow-up questions were used. These questions were formulated carefully before the testing began, and all the examiners used the same questions" (4, p. 44).

The results of the group tests were presented in the form of distributions of scores, of relative difficulty of the terms, of misconceptions indicated by selections of incorrect responses, of variations among school systems and of percentage of pupils who responded consistently on all four tests.

The results of the individual tests were presented as, "first, the responses made by the pupils to each of the twenty-five words in the list; second, the responses made to certain of the phrases used; and, third, the types of responses to selected terms made by the pupils at the three levels of intelligence."

Buswell and John summarize the results of the group tests as follows:

1. The pupils in a given grade differ widely in the size of their arithmetical vocabularies. The number of terms known increases from grade to grade, but the distribution of scores in the three grades show a large amount of overlapping.

2. The difficulty of the terms studied as indicated by the percentages of pupils responding correctly shows great variation.

3. The difficulty of the classes of terms into which the list is divided indicates that, in general, the technical terms are the most difficult and that the terms relating to time, space, or quantity are the least difficult, the terms relating to special figures, the terms of measurement, and the commercial terms lying between the extremes. The fact that there are more terms included in some classes than in others and that the terms in a given class are not of uniform difficulty reduces the significance of the differences between the results for the five classes.

4. The growth in the understanding of terms as indicated by the increase in the percentage of correct responses from Grade IV to Grade VI shows great variation for different terms, the smallest difference in percentages being 1.4 and the largest 60.2.

5. Comparison of the results for the twelve school systems represented by the pupils tested shows that for a given term the percentages of correct responses and the percentages of omissions vary widely, indicating that the course of study and the teaching procedure are probably important factors in determining the terms known by the pupils in each school system.

6. Analysis of the incorrect responses indicates that incorrect meanings are frequently associated with terms. In some cases the number of pupils who had misconceptions regarding the term was greater than the number of pupils who understood it, and the amount of misunderstanding did not decrease materially from Grade IV to Grade VI. Such a situation presents a definite problem for teachers of arithmetic.

7. The lack of agreement between the results of Tests I, II, III, and IV suggests that ability to respond to a word correctly in one situation does not necessarily indicate that understanding is complete. Further experience with the word may be needed for complete understanding (4, pp. 41 and 42).

RESTATEMENT OF PROBLEM

Most of the investigations which have been referred to consist primarily either in a listing of geographic terms or in a statement of the final results of learning such terms. Little or no effort has been made to get beneath the surface and to study the learning process in operation. The one outstanding exception is the study by Brownell on the development of the children's number ideas. It is the purpose of the present investigation to isolate some of the factors and principles which condition learning and consequently growth in understanding of geographic terms.

CHAPTER II

EXPERIMENTAL PROCEDURE

SELECTION OF TERMS

A list of 135 geographic terms was derived from an examination of geography texts¹ in use in the public schools of Greenwood, South Carolina. The terms included in the list were those which, in the opinion of the writer, were best adapted to the purposes of this investigation. The one criterion other than personal opinion used in the selection of terms was "frequency of occurrence." On this basis a term was selected (1) if it occurred as many as three times in the textbook material studied, or (2) if it was closely identified with the use of maps. The criterion of "frequency" was used because it was felt that there should be some measure of the probable opportunity which children had had for learning the meanings of the terms. Such a measure is needed to evaluate responses.

The list of terms was divided into three parts which will be referred to hereinafter as Part I, Part II, and Part III.

Part I consisted of 60 terms. Of these, 49 terms occurred as many as three times in the textbook material which had been studied by each of Grades IV, V, VI, and VII. The following eleven terms occurring less than three times—*antarctic circle*, *arctic circle*, *hemisphere*, *latitude*, *longitude*, *meridian*, *north pole*, *parallel*, *south pole*, *tropic of Cancer*, and *tropic of Capricorn*—were also included in Part I because it was felt that children would probably have meanings for them by reason of use in connection with maps.

Part II consisted of 20 terms, each of which occurred as many as three times in the textbook material studied by each of Grades V, VI, and VII, but which did not occur as many as three times in the material studied by Grade IV.

Part III consisted of 55 terms, each of which occurred as many as three times in the textbook material studied by Grade VII but

¹ The texts were:

a. Wallace Walter Atwood and Helen Goss Thomas, *The Earth and Its People, Elementary Book* (Boston: Ginn and Co., 1934).

b. Wallace Walter Atwood and Helen Goss Thomas, *The Earth and Its People, Advanced Book* (Boston: Ginn and Co., 1934).

c. Joseph Russell Smith, *Human Geography, Book One* (Philadelphia: John C. Winston Co., 1925).

d. Wallace Walter Atwood, *New Geography, Book II* (Boston: Ginn and Co., 1929).

TABLE 1
TERMS USED IN THIS INVESTIGATION AND THEIR OCCURRENCE IN OTHER
VOCABULARY STUDIES*

| Serial Numbers | Terms | Part of M. C. Test in Which Term Occurs | Thorndike Credit Numbers | Barrows and Parker (pp. 1-257) | Bright and McFarlane (pp. 81-153) | Fairgrieve and Young (pp. 3-452) | McMurry and Parkina (pp. 67-156) | Cole | Pease | Number of Lists in Which Terms Occur |
|----------------|-----------------------------|---|--------------------------|--------------------------------|-----------------------------------|----------------------------------|----------------------------------|-------|-------|--------------------------------------|
| 1 | Altitude..... | III | ..... | ..... | ..... | ..... | x | x | x | 3 |
| 2 | Annual rainfall..... | III | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0 |
| 3 | Antarctic circle..... | I | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0 |
| 4 | Arctic circle..... | I | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0 |
| 5 | Area..... | III | 3a | x | x | x | x | x | x | 6 |
| 6 | Basin..... | I | 3b | ..... | ..... | x | ..... | x | x | 4 |
| 7 | Bay..... | I | 1b | x | x | x | x | ..... | x | 5 |
| 8 | Belt..... | II | 2b | x | x | x | x | x | ..... | 5 |
| 9 | Boundary..... | II | 3b | x | x | x | ..... | ..... | x | 5 |
| 10 | Canal..... | I | 3a | x | x | x | x | x | x | 6 |
| 11 | Canyon..... | III | ..... | x | x | x | x | ..... | x | 5 |
| 12 | Capital (of a country)..... | II | 2b | x | x | x | x | x | x | 6 |
| 13 | Center..... | I | 1b | x | x | x | x | ..... | ..... | 4 |
| 14 | Central..... | I | 2b | x | x | x | x | ..... | ..... | 4 |
| 15 | Climate..... | II | 3a | x | x | x | x | x | x | 6 |
| 16 | Coal field..... | II | ..... | ..... | ..... | ..... | ..... | ..... | x | 1 |
| 17 | Coast..... | I | 1b | x | x | x | x | ..... | x | 5 |
| 18 | Coast line..... | III | ..... | ..... | ..... | ..... | ..... | ..... | x | 1 |
| 19 | Commerce..... | III | 2b | ..... | x | ..... | x | x | x | 4 |
| 20 | Communication..... | III | 4b | x | ..... | ..... | ..... | ..... | x | 2 |
| 21 | Continent..... | I | 3a | x | x | x | ..... | x | x | 5 |
| 22 | Country..... | I | 1a3 | x | x | x | x | ..... | x | 5 |
| 23 | Degree (angle)..... | III | 2a | x | ..... | x | ..... | ..... | ..... | 2 |
| 24 | ° (symbol for degree)..... | III | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0 |
| 25 | Delta..... | II | ..... | x | x | x | x | x | ..... | 5 |
| 26 | Dense population†..... | II | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0 |
| 27 | Deposits (noun)..... | III | 3b | x | x | x | x | x | ..... | 5 |
| 28 | Desert..... | I | 2a | x | ..... | x | x | x | x | 5 |
| 29 | Dike..... | I | ..... | x | ..... | ..... | ..... | ..... | ..... | 1 |
| 30 | Distance..... | III | 1b | x | x | x | x | ..... | x | 5 |
| 31 | Distribution..... | III | 5a | x | ..... | x | x | ..... | ..... | 3 |
| 32 | Domesticated..... | III | 3a | ..... | ..... | ..... | ..... | ..... | ..... | 0 |
| 33 | Downstream..... | III | ..... | x | ..... | x | ..... | ..... | ..... | 2 |
| 34 | Dune..... | III | ..... | x | ..... | ..... | x | ..... | ..... | 2 |
| 35 | Earthquake..... | III | 4b | ..... | ..... | x | ..... | ..... | x | 2 |
| 36 | East wind..... | III | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0 |
| 37 | Eastward..... | I | ..... | x | ..... | ..... | x | ..... | x | 3 |
| 38 | Elevation..... | III | ..... | x | x | ..... | x | x | x | 5 |
| 39 | Equator..... | I | ..... | x | ..... | x | ..... | x | x | 4 |
| 40 | Estuary..... | III | ..... | ..... | ..... | x | ..... | ..... | ..... | 1 |
| 41 | Export (verb)..... | I | 5b | ..... | x | x | x | x | x | 5 |
| 42 | Fuel..... | I | 3b | x | x | x | x | x | x | 6 |
| 43 | Glacial deposit..... | III | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 0 |
| 44 | Glacier..... | III | ..... | x | x | x | x | x | x | 6 |
| 45 | Gorge..... | III | ..... | ..... | x | x | x | ..... | x | 4 |

*For a statement of these studies see Chapter I. The text of J. Russell Smith is not listed in Table 1 for the reason that it was one of the texts from which the terms were derived. A comparison with the vocabulary list of Notz was not made because that list was derived from fifth-grade geography texts only.

†Includes *population is dense*. By mistake this phrase appeared in the multiple choice test as *population*. The term *population* appears in Part III.

TABLE 1 (Continued)

| Serial Numbers | Terms | Part of M. C. Test in Which Term Occurs | Thorndike Credit Numbers | Barrows and Parker (pp. 1-257) | Brigham and McFarlane (pp. 81-153) | Fairgrieve and Young (pp. 3-452) | McMurry and Parkins (pp. 67-156) | Cole | Pease | Number of Lists in Which Terms Occur |
|----------------|---------------------------------|---|--------------------------|--------------------------------|------------------------------------|----------------------------------|----------------------------------|------|-------|--------------------------------------|
| 46 | Gulf..... | I | 3b | | | x | | x | | 2 |
| 47 | Harbor..... | I | 2b | x | x | x | x | x | x | 6 |
| 48 | Headwaters..... | III | | | | | | | | 0 |
| 49 | Heavy rainfall..... | III | | | | | | | | 0 |
| 50 | Hemisphere..... | I | | | | | | x | x | 2 |
| 51 | Highlands..... | II | | x | x | x | x | x | | 5 |
| 52 | Hill..... | I | 1a4 | x | x | x | x | | x | 5 |
| 53 | Horizon..... | III | 4b | x | | | | x | x | 3 |
| 54 | Import (verb)..... | II | 3b | | x | | x | x | x | 4 |
| 55 | Industry..... | II | 2b | x | | x | x | x | x | 5 |
| 56 | Inhabitants..... | III | 5a | x | x | x | x | x | x | 6 |
| 57 | Inland..... | I | 5a§ | x | x | x | | | x | 4 |
| 58 | Interior..... | II | 3b | x | x | x | x | | | 4 |
| 59 | Internationalized (river)..... | III | | | | | | | | 0 |
| 60 | Irrigation..... | II | | x | | x | x | x | | 4 |
| 61 | Island..... | I | 1b | x | x | x | x | | x | 5 |
| 62 | Junction..... | III | | x | x | x | | | | 3 |
| 63 | Kingdom..... | II | 2a | | x | | x | | | 2 |
| 64 | Lake..... | I | 1b | x | x | x | x | | x | 5 |
| 65 | Latitude..... | I | | | x | | | x | x | 3 |
| 66 | Longitude..... | I | | | | | | x | x | 2 |
| 67 | Lowlands..... | I | 5b | x | x | x | x | x | x | 6 |
| 68 | Mainland..... | III | | | x | | x | x | x | 4 |
| 69 | Manufacturing..... | I | 22b-5b | x | x | x | x | x | x | 6 |
| 70 | Meridian..... | I | | | x | | x | | | 2 |
| 71 | Mineral wealth..... | III | | | | | | | x | 1 |
| 72 | Mountain..... | I | 1a5 | x | x | x | x | | x | 5 |
| 73 | Mouth (river)..... | I | 1b | x | x | x | x | x | x | 6 |
| 74 | Native (noun)..... | I | 2a | x | x | x | x | x | x | 6 |
| 75 | Natural region..... | III | | | | | | | | 0 |
| 76 | Natural resources..... | III | | | | | | | x | 1 |
| 77 | Navigable..... | III | | | | | x | x | | 2 |
| 78 | Navigation..... | III | | | | x | x | x | x | 4 |
| 79 | North..... | I | 1a4 | x | x | x | x | | x | 5 |
| 80 | North pole..... | I | | x | | | | | x | 2 |
| 81 | Oasis..... | III | | x | | | | x | | 2 |
| 82 | Occupation..... | III | 3b | | | | x | x | | 2 |
| 83 | Ocean..... | I | 1b | x | x | x | x | x | x | 6 |
| 84 | Ore..... | II | 5b | x | x | x | x | x | x | 6 |
| 85 | Parallel..... | I | 4b | | | x | x | | | 2 |
| 86 | Peak..... | III | 4b | x | x | | x | x | x | 5 |
| 87 | Peninsula..... | I | 5a | x | x | x | x | x | x | 6 |
| 88 | Physical features..... | III | | | | | | | | 0 |
| 89 | Plain..... | I | 1a5 | x | x | x | | | x | 4 |
| 90 | Plateau..... | II | 5a | x | x | x | x | x | x | 6 |
| 91 | Population..... | III | 3a | x | | x | x | x | x | 6 |
| 92 | Possessions (of a country)..... | II | 2b | | x | | x | | x | 3 |
| 93 | Power..... | I | 1a4 | x | x | x | | | x | 4 |
| 94 | Prevailing winds..... | III | | | | | | | | 0 |

§Included in 1927 edition of *The Teacher's Word Book*.

TABLE 1 (Continued)

| Serial Numbers | Terms | Part of M. C. Test in Which Term Occurs | Thorndike Credit Numbers | Barrows and Parker (pp. 1-257) | Brigham and McFarlane (pp. 81-153) | Fairgrieve and Young (pp. 3-452) | McMurry and Parkins (pp. 67-156) | Cole | Pease | Number of Lists in Which Terms Occur |
|----------------|--------------------------|---|--------------------------|--------------------------------|------------------------------------|----------------------------------|----------------------------------|------|-------|--------------------------------------|
| 95 | Rainfall..... | II | 5b | x | x | x | x | x | x | 6 |
| 96 | Rainfall, inches of..... | II | 1b | | | | | | | 0 |
| 97 | Rapids..... | III | 1b | x | x | | x | x | | 4 |
| 98 | Raw material..... | I | | | | | | x | x | 2 |
| 99 | Republic..... | III | 3b | | x | | x | x | x | 4 |
| 100 | River..... | I | 1a3 | x | x | x | x | | x | 5 |
| 101 | Route..... | I | 3a | x | x | x | x | x | x | 6 |
| 102 | Sea..... | I | 1a3 | x | x | x | x | | x | 5 |
| 103 | Sea level..... | I | | | | | | x | x | 2 |
| 104 | Seaport.*..... | I | | x | x | | x | x | x | 5 |
| 105 | Season..... | I | 1b | x | x | x | x | x | x | 6 |
| 106 | Slopes (noun)..... | I | 2b | x | | x | x | x | x | 5 |
| 107 | Snow (noun)..... | I | 1b | x | x | x | x | | x | 5 |
| 108 | South pole..... | I | | | | | | | x | 1 |
| 109 | Southern..... | I | 2b | x | x | x | x | | x | 5 |
| 110 | Strait..... | I | 3b | x | | | | x | x | 3 |
| 111 | Summit..... | III | 5a | x | x | x | x | x | | 5 |
| 112 | Surface..... | I | 2b | x | x | x | x | x | x | 6 |
| 113 | System..... | II | 2a | x | | x | x | | | 3 |
| 114 | Temperate zone..... | III | | | | | | | | 0 |
| 115 | Temperature..... | III | 3b | x | x | x | x | x | x | 6 |
| 116 | Trade (noun)..... | I | 1b | x | x | x | x | | x | 5 |
| 117 | Trade winds..... | III | | | | | | | x | 1 |
| 118 | Transportation..... | III | 4b | x | | x | x | x | x | 5 |
| 119 | Tributaries..... | III | 4a | x | x | x | x | x | | 5 |
| 120 | Tropic of Cancer..... | I | | | | | | | | 0 |
| 121 | Tropic of Capricorn..... | I | | | | | | | | 0 |
| 122 | Tropical..... | III | | x | x | | x | x | x | 5 |
| 123 | Tundra..... | III | | | | | | | | 0 |
| 124 | Uncivilized††..... | III | | x | | x | x | | | 3 |
| 125 | Uplands..... | III | | x | x | x | | x | | 4 |
| 126 | Upstream..... | I | | x | | x | | | | 2 |
| 127 | Valley..... | I | 1b | x | x | x | | | x | 4 |
| 128 | Vegetation..... | III | | x | | x | x | x | x | 5 |
| 129 | Volcano..... | II | | x | x | x | x | x | x | 6 |
| 130 | Waterfall..... | III | 5a | x | | x | | | | 2 |
| 131 | Waterway..... | III | | | x | x | x | x | x | 5 |
| 132 | Weather..... | I | 1b | x | x | x | x | | x | 5 |
| 133 | West coast..... | I | | | | | | | | 0 |
| 134 | World..... | I | 1a2 | x | x | x | x | | x | 5 |
| 135 | Year..... | I | 1a1 | x | x | x | x | | x | 5 |

††Includes *civilized*.
*Estimated.

which did not occur as many as three times in the material studied by *each* of the three preceding grades.

The list of terms with notations as to their occurrence in other vocabulary lists is found in Table 1 (last eight columns).

COMPARISON WITH OTHER VOCABULARY LISTS

In evaluating the list of geographic terms used in this investigation, one should bear in mind the purpose for which the list was derived, namely, to study growth of meanings. While no effort was made to make up a list of geographic terms for any purpose other than the one stated, it is interesting to compare the list with other lists prepared for different purposes.

Table 2 reports the number of the 135 terms in the present list which occur also in the vocabularies indicated in Table 1. On the whole it would seem that important geographic terms had been selected for study.

TABLE 2

NUMBERS OF THE 135 TERMS IN PRESENT LIST WHICH OCCUR ALSO IN THE VOCABULARIES INDICATED IN TABLE 1

| Text or List | Frequency |
|---|-----------|
| Thorndike (first five thousand) | 76 |
| Barrows and Parker | 85 |
| Brigham and McFarlane | 75 |
| Fairgrieve and Young | 81 |
| McMurry and Parkins | 81 |
| Cole | 63 |
| Pease | 85 |
| As many as four lists | 78 |

THE MAIN TESTS

Five types of test were used in the main part of this investigation. They were: (1) an essay test; (2) a multiple choice test; (3) an identification test; (4) an intelligence test; and (5) a concrete material test. Test 5 was an individual test; the others were group tests.

1. *Essay Test.*

The essay test was administered to approximately five hundred children in the fourth, fifth, sixth, and seventh grades. The form consisted of ruled mimeographed sheets on which spaces were provided for name, address, grade, section, etc. At the top of each sheet and immediately following the spaces provided for personal data there was printed "Word. . . ." The mimeographed sheets were stapled together in pads of ten pages each. On each sheet of a pad and in the space immediately following "Word" was written one of the 135 terms used in the study. After desks had been cleared and pencils sharpened, the pads were distributed. The children were then instructed to write, in the spaces provided for the purpose, what they

thought the words meant. Two plans were followed in giving the instructions.

The instructions according to *plan one* follow in part:

The pad which you have been given has ten pages in it. Fill in the blanks at the top of the first page. [After the blanks had been filled in the examiner continued.] At the top of each sheet a word has been written. The first word is *rainfall*. Your geography has often spoken of *rainfall* in telling about the countries which you have studied. I want to know what you think *rainfall* means. Write anything you want to that will show me that you know what *rainfall* means in geography. Just a sentence or two will do. Write on the first page of your pad.

When all had finished the examiner continued:

Turn to the next sheet. The word at the top of the page is *east wind*. In your geography you have read about winds of many kinds. I want to know what you think an *east wind* is. Take your pencil and write what you think an *east wind* is.

Similar instructions were given with respect to the remaining eight terms.

After the essay testing according to the first plan of instructions had been completed, each child was given a number which identified him in his grade. This number was later written on each sheet of each pad which the child had accepted. A record was kept of the name, number, school, and teacher of each child who was tested. In all, 4,711 essays were secured according to *plan one*. The number of essays is not a multiple of ten because in some few cases only nine sheets were included in a pad. The majority of essays were one and two sentences in length.

The instructions given for *plan two* differed from those for *plan one* only in that the children were encouraged to write as much as they could about a term. Approximately two thousand essays were secured according to *plan two*. Many of these essays were only one or two sentences in length, a few pages were blank, and a few answers were almost a page in length. The terms about which the essays were written were not identical in every case with those listed in Table 1.

In order to make it easier to deal with all the essays about each of the terms, the pads were taken apart, one grade at a time, and the sheets reassembled so that all the essays from a grade about a given term were together. The essays collected according to the two plans of instructions were reassembled separately.

The essays will be referred to in the next section of this chapter in connection with the construction of the multiple choice test and again in Chapters III and IV.

2. Multiple Choice Test.

The multiple choice test which was used in this investigation was of the familiar type. There were, however, two variations, one of which proved very significant.

As in other multiple choice tests, each test item was presented with four possible meanings. Besides these four alternatives, two others were added. One was an "I don't know" alternative, and the other an "I think it means . . ." alternative. The following item taken from the test illustrates the kind of alternatives which were used:

The *central* part of the country means:

- () 1. The part of the country which has the hottest weather.
- () 2. The part of the country which is surrounded by mountains.
- () 3. The middle of the country.
- () 4. The edge of the country.
- () 5. I don't know.
- () 6. I think it means. . .

In the instructions which accompanied the test, the subjects were told that if they thought one of the four answers was a good one they were to put a cross (X) in the space in front of that answer; that if they did not know the meaning of a term, not to guess at it but to put a cross (X) in the space in front of "I don't know"; and finally, that if they knew the meaning of a term and did not think that one of the four answers given was a good one, to write what they thought the word meant in the space after "I think it means. . ."

In order to secure to the fullest extent the advantages offered by the "I think it means . . ." alternative, it seemed desirable to prevent the subjects from acting on the assumption that one of the first four alternatives was always correct. Consequently, terms were included in the test for which none of the alternatives were correct. There were 21 such items out of 135. The subjects were warned that items of this kind had been included in the test, and one of the sample items in the pretest was deliberately made of this type.

The meanings which were written as number-six alternatives (that is, the answers which were written after "I think it means . . .") will be referred to in reporting this investigation as the "number-six answers."

Selection of alternatives. The alternatives of a test should probably not be selected purely on a subjective basis, although there is no generally recognized principle of test construction to this effect. Nevertheless, in the very idea that the alternatives constitute a "test," there is an implicit recognition of the fact that each alternative *might* be selected by at least some of the subjects. In this particular multiple choice test, the alternatives used were chosen wherever possible from the ideas expressed by the children in their essays. It is felt that, in spite of whatever limitations the test may have, it is a far more effective instrument for determining meanings and growth of understanding than it would have been, had not the alternatives been determined in large measure from the ideas expressed in the essays.

3. Identification Test.

The identification test consisted of four maps and seventeen terms related to the maps and selected from Part I of the multiple choice test. Four maps rather than one were used in the test in order to avoid a mass of confused detail. Two of the maps were of a hypothetical country and showed such physical and geographic features as rivers, mountains, peninsulas, islands, etc. The other two maps showed parallels, meridians, etc.

Most of the seventeen items were represented twice or more times, sometimes on one map, sometimes on two maps. Each item was marked on the maps with its identifying letter several times in order to minimize doubt as to which of the items each letter stood for. In order to decrease the probability of a child's identifying correctly items with which he was unfamiliar, by eliminating items already identified, a few features were marked on the maps, although there were no corresponding terms in the test. The subjects were warned in the directions that such features had been marked and they were cautioned to be careful in their identifications.

4. Intelligence Test.

The intelligence test which was used in this investigation was the National Intelligence Test, Scale A, Form I. This is a battery test consisting of five parts, each of which is preceded by a practice exercise. The five tests, named in the order of their occurrence, are: arithmetical reasoning, sentence completion, logical selection, same-opposites, and symbol-digit (substitution). The National Intelligence Test is so well known that a further description is unnecessary.

5. Concrete Material Test.

The materials of this test were: (a) an ordinary 12-inch globe showing political divisions, (b) two large specially made map-models showing the physical features of a hypothetical country, and (c) two smaller models which were similar to the large ones. The models were made from newspaper pulp to which paste had been added, and were mounted on wooden bases. The bases of the two larger models were 2 feet by 3 feet; those of the smaller ones, approximately 10 inches by 14 inches.

The subjects were taken one by one to a quiet room and shown the globe and the models of the test. After they had become adjusted to their surroundings, the examiner proceeded as follows:

Here are some maps. They are not really maps of a part of the world but just some maps which were made to show rivers, mountains, islands, and a lot of other things which you have studied about in geography. Look at them. Here is the ocean, and there is the land. On this other map the ocean, or rather just one part of it, is here. We used real water in order to make the ocean look like a real one. This is the land up here. Look at the maps now and see if you can find a bay.

If the subject merely nodded his head or appeared uncertain what to do, the examiner continued, "Show me a bay. Put your finger on a bay." In this manner the subjects were tested on the seventeen terms which had been included in the identification test.

THE TESTING

Dates.

The essays which were written under the first plan of instruction were secured during the fall and winter of 1935-36. Those written under the second plan were collected during the spring and fall of 1935. The multiple choice, identification, and intelligence tests were given between March 24 and April 27, 1936; and the concrete material test, during May of the same year.

Examiners.

A large part of the testing was done by the writer personally. The necessity of completing the testing within a comparatively short period of time made it necessary for him to have assistance. This assistance was given by selected students who were taking work in Education as members of the writer's classes. In every case the students who assisted in the testing were given careful instructions and training in what they should do. In some few other cases

multiple choice and identification tests were given by the classroom teachers.

Conditions of Testing.

Each test was given to the different sections of the grades under conditions which were as nearly identical as possible. The National Intelligence Test was administered with a rigid adherence to the conditions laid down in the manual of instructions.

The multiple choice test required two days to administer, Parts I and II, and Part III being given on alternate days. The tests were so arranged that in each school one section of each grade took Parts I and II on the first day, and the other section Part III. On the second day the test was completed. The purpose of administering the test in this manner was to equalize such advantages as might be gained by taking either half of the test first.

Each child was allowed all the time he needed to complete the four vocabulary tests.

SCORING THE TESTS

The tests were scored under the direction of the writer by students in the Department of Education at Lander College. An exception to this statement is made with respect to the number-six answers of the multiple choice test, all of which were scored by the writer personally.

In the case of the multiple choice test the numbers of the correct alternatives were read from a key to a group of students who marked the incorrect items on the tests which they were scoring. Later the number-six answers were read carefully by the writer and scored as either acceptable or unacceptable on the basis of his personal judgment. The sum of the correct items in the three parts of the test constituted the total score.

The identification tests were scored by comparing the answers given with the key, a copy of which was written on the blackboard. The score was the number of items which had been identified correctly.

Special instructions were given in the scoring of the National Intelligence Tests, and each of these tests was scored twice by independent scorers. In all cases when two independent scorers differed in their judgment as to the way an item should be marked, the writer was consulted for a final opinion.

The score on the concrete material test was the number of correct responses which had been made.

Sampling of Errors.

In order to determine the accuracy with which the scoring had been done, four samples each of the multiple choice, identification, and National Intelligence Tests were selected at random from each section and were scored by the writer personally. Since the number of pupils in a section who were tested varied from 13 to 20 (see Table 4, p. 27), it follows that the proportion of the tests which were rescored varied from 31 to 20 per cent of the total number.

Table 3 reports a summary of the number of scoring errors which were found in the rescored tests. The table shows that with respect

TABLE 3
NUMBER OF SCORING ERRORS IN SAMPLE TESTS SELECTED AT RANDOM FROM
NATIONAL INTELLIGENCE, MULTIPLE CHOICE, AND IDENTIFICATION TESTS

| | TESTS | | |
|--|----------|--------|-------|
| | N. I. T. | M. C. | Iden. |
| Maximum number of scoring errors in single paper.... | 2 | 2 | 1 |
| Total number of sample tests rescored..... | 96 | 96 | 96 |
| Total number of scoring errors..... | 16 | 23 | 6 |
| Total number of items in sample tests..... | 9,600* | 12,960 | 1,632 |
| Per cents errors are of items..... | .17 | .18 | .37 |

*Estimated.

to each of the three tests the total number of scoring errors was less than four tenths of one per cent. It is evident from the small number of errors found in the sample tests that the original scoring had been done with a very high degree of accuracy.

TABULATION OF DATA

To tabulate the data from the multiple choice test, the numbers of the chosen alternatives were dictated to an assistant who recorded the frequencies on forms prepared for the purpose. Provision was made on the forms for entering the frequencies of ambiguous answers, omissions, and number-six answers which were correct. The total number of correct responses for each term was later determined, by grades, by adding the frequency of the correct number-six answers to the frequency of the correct alternative. In the case of those terms for which none of the alternatives were correct, the total number of correct responses was the number of correct number-six answers. When the tabulation of data had been completed all frequencies were expressed as per cents of the number of children in the groups² and the grades.

² For a statement of the significance of "groups" see *Conditioning Factor 3. Level of Geographic Attainment* (chap. iii, p. 37).

The data from the identification test were tabulated for the different grades by recording the frequency with which each letter had been used in identifying each of the seventeen terms of the test. The frequencies were later expressed as per cents of children in the grades.

The data from the concrete material test were tabulated by grades, by recording the frequency with which each term had been responded to correctly. These frequencies were later expressed as per cents of children in the grades.

SELECTION OF SUBJECTS³

The subjects used in this investigation were drawn from the fourth, fifth, sixth, and seventh grades of the white public schools of Greenwood, South Carolina. There are in this city three principal elementary schools, and all of them contributed equally to the sample of pupils which was selected. The public schools of Greenwood are organized on the 7-4 plan; formal study of geography is begun in the fourth grade and is continued through the seventh; and the enrollment is confined almost exclusively to children of native-born American parents.

In two of the schools there were two sections per grade. In the third, there were three sections of the fourth grade and two sections of each of the other two grades. The sections in the schools are divided, not according to ability, but according to the alphabet or some similar scheme, and are designated by the letters A, B, and C. These letters have no significance whatever in terms of semiannual promotion or degree of mental maturity. The letters are used merely to distinguish sections. From two sections of each grade in each school an approximately equal number of children was chosen for testing.

The selection of subjects was made on the basis of teacher-judgment. The plan was as follows: Several days before the tests were to be given, the teachers were told of the tests, and their co-operation was secured. Each teacher was asked to choose from her geography class seventeen or eighteen children to take the tests. It was clearly understood that the chosen children were to represent a fair sampling of the class as a whole; that is, they were to include a few who were among the very best in geography, a few who were poor, and a majority who were average. The teachers were asked, however, not to in-

³ The reference here is to the children who took the multiple choice, identification, National Intelligence, and concrete material tests. The selection of subjects who took the essay test has been treated under *1. Essay Test* (p. 19).

clude among their selections any child who was so badly handicapped by excessive emotional reactions, language difficulties, or low mentality as to be an unfit subject for testing. Furthermore, no child was to be forced to take the tests. When a child who had been selected objected to taking the tests, he was promptly excused and another selected to take his place. The samples of subjects obtained in this way are believed to be representative of the sections.

In all, 405 children were tested. Usable multiple choice and identification test scores were obtained from 391 of these children, and usable National Intelligence Test scores from all but 14 of the 391 children from whom multiple choice and identification test scores had been obtained. Concrete material test scores were obtained from 61 of those children who had taken both the multiple choice and the identification tests.

In Table 4 is shown the number of children from whom test scores were secured, by schools, grades, and sections. The method of reading the table is as follows: In section A of the fourth grade of Blake School there were 17 children from whom both multiple choice and identification test scores were secured, 15 children from

TABLE 4

NUMBERS OF CHILDREN FROM WHOM MULTIPLE CHOICE, IDENTIFICATION, NATIONAL INTELLIGENCE, AND CONCRETE MATERIAL TEST SCORES WERE SECURED, BY SCHOOLS, GRADES, AND SECTIONS

| Schools and Sections | GRADE IV | | | GRADE V | | | GRADE VI | | | GRADE VII | | |
|----------------------|-----------------|----------------------------|---------------------------------|-----------------|----------------------------|-----------------------------|-----------------|----------------------------|-----------------------------|-----------------|----------------------------|-----------------------------|
| | M. C. and Iden. | M. C., Iden., and N. I. T. | M. C., Iden., and Con. Material | M. C. and Iden. | M. C., Iden., and N. I. T. | M. C., Iden., and Con. Mat. | M. C. and Iden. | M. C., Iden., and N. I. T. | M. C., Iden., and Con. Mat. | M. C. and Iden. | M. C., Iden., and N. I. T. | M. C., Iden., and Con. Mat. |
| BLAKE | | | | | | | | | | | | |
| Section A..... | 17 | 15 | 0 | 18 | 17 | 0 | 16 | 16 | 0 | 17 | 15 | 0 |
| Section B..... | 20 | 17 | 0 | 18 | 18 | 0 | 18 | 17 | 0 | 17 | 17 | 0 |
| LESLIE | | | | | | | | | | | | |
| Section A..... | 17 | 16 | 4 | 17 | 17 | 5 | 14 | 14 | 6 | 17 | 16 | 4 |
| Section B..... | 13 | 13 | 4 | 16 | 15 | 5 | 17 | 17 | 5 | 16 | 16 | 9 |
| MAGNOLIA | | | | | | | | | | | | |
| Section A..... | 15 | 15 | 0 | 14 | 14 | 3 | 16 | 16 | 2 | 14 | 13 | 3 |
| Section B..... | 16 | 15 | 0 | 16 | 16 | 1 | 16 | 16 | 4 | 16 | 16 | 6 |
| Total.....* | 98 | 91 | 8 | 99 | 97 | 14 | 97 | 96 | 17 | 97 | 93 | 22 |

| | |
|---|-----|
| Total number of children from whom both multiple choice and identification test scores were secured..... | 391 |
| Total number of children from whom multiple choice, identification, and National Intelligence Test scores were secured..... | 377 |
| Total number of children from whom multiple choice, identification, and concrete material test scores were secured..... | 61 |

whom multiple choice, identification, and National Intelligence Test scores were secured, and 0 children from whom multiple choice, identification, and concrete material test scores were secured. The rest of the row and table is read in a similar manner.

GROSS DATA

MEDIAN SCORES OF SAMPLES

Tables 5, 6, 7, and 8 contain the medians for test scores and for supplementary items by schools, grades, and sections.⁴ Table 5 is read as follows: In section A of the fourth grade of Blake School 8 boys and 9 girls, a total of 17 children, were tested. The median National Intelligence Test score, mental age, chronological age, intelligence quotient, multiple choice, and identification test scores were 77.0, 127.0, 125.0, 99.0, 42.0, and 9.0, respectively.

Tables 6, 7, and 8, for Grades V, VI, VII, and VIII, respectively, were constructed as was Table 5 and are to be interpreted in the same way as Table 5.

SUPPLEMENTARY TEST

In addition to the tests used in the main part of this investigation, there was also given a supplementary multiple choice test comprised of fifteen terms⁵ common to the main multiple choice test and constructed for the purpose of obtaining special data. The principles followed in the construction, administration, and scoring of the test were

TABLE 5
FOURTH-GRADE MEDIANS FOR NATIONAL INTELLIGENCE, MULTIPLE CHOICE, AND IDENTIFICATION TEST SCORES, AND FOR SUPPLEMENTARY ITEMS, BY SCHOOLS AND SECTIONS

| School and Section | SEX | | | MEDIANS | | | | | |
|--------------------|------|-------|-------|-----------------|-------|-------|-------|-------|-------|
| | Boys | Girls | Total | Natl. Int. Test | M. A. | C. A. | I. Q. | M. C. | Iden. |
| Blake.....A | 8 | 9 | 17 | 77.0 | 127.0 | 125.0 | 99.0 | 42.0 | 9.0 |
| Blake.....B | 10 | 10 | 20 | 81.0 | 130.0 | 118.0 | 107.0 | 56.0 | 7.5 |
| Leslie.....A | 8 | 9 | 17 | 82.5 | 130.5 | 124.0 | 109.0 | 41.0 | 6.0 |
| Leslie.....B | 7 | 6 | 13 | 95.0 | 139.0 | 118.0 | 118.0 | 67.0 | 10.0 |
| Magnolia....A | 9 | 6 | 15 | 87.0 | 134.0 | 123.0 | 109.0 | 55.0 | 9.0 |
| Magnolia....C | 5 | 11 | 16 | 86.0 | 133.0 | 120.0 | 112.0 | 53.0 | 7.0 |
| All sections..... | 47 | 51 | 98 | 84.0 | 132.0 | 121.0 | 109.0 | 52.4 | 8.0 |

⁴ Medians for concrete material test are not reported for the reason that the number of cases per section was limited in most cases to only a few subjects.

⁵ The terms were: *altitude, coast, communication, deposit, desert, dune, fuel, industry, latitude, occupation, ore, power, strait, transportation, and vegetation*. Each of these terms occurred in the vocabulary list reported in Table 1.

TABLE 6

FIFTH-GRADE MEDIANS FOR NATIONAL INTELLIGENCE, MULTIPLE CHOICE, AND IDENTIFICATION TEST SCORES, AND FOR SUPPLEMENTARY ITEMS, BY SCHOOLS AND SECTIONS

| School and Section | SEX | | | MEDIANS | | | | | |
|--------------------|------|-------|-------|-----------------|-------|-------|-------|-------|-------|
| | Boys | Girls | Total | Natl. Int. Test | M. A. | C. A. | I. Q. | M. C. | Iden. |
| Blake.....A | 5 | 13 | 18 | 94.0 | 138.0 | 134.0 | 102.0 | 55.0 | 6.0 |
| Blake.....B | 10 | 8 | 18 | 100.5 | 143.5 | 136.0 | 102.0 | 60.0 | 8.5 |
| Leslie.....A | 9 | 8 | 17 | 104.0 | 146.0 | 133.0 | 109.0 | 64.0 | 10.0 |
| Leslie.....B | 8 | 8 | 16 | 110.0 | 151.0 | 136.0 | 112.0 | 60.5 | 8.0 |
| Magnolia....A | 9 | 5 | 14 | 107.0 | 148.0 | 134.5 | 112.5 | 65.5 | 11.5 |
| Magnolia....B | 9 | 7 | 16 | 106.0 | 147.0 | 135.0 | 108.0 | 65.5 | 12.5 |
| All sections.... | 50 | 49 | 99 | 103.0 | 145.0 | 135.0 | 108.0 | 61.2 | 9.9 |

TABLE 7

SIXTH-GRADE MEDIANS FOR NATIONAL INTELLIGENCE, MULTIPLE CHOICE, AND IDENTIFICATION TEST SCORES, AND FOR SUPPLEMENTARY ITEMS, BY SCHOOLS AND SECTIONS

| School and Section | SEX | | | MEDIANS | | | | | |
|--------------------|------|-------|-------|-----------------|-------|-------|-------|-------|-------|
| | Boys | Girls | Total | Natl. Int. Test | M. A. | C. A. | I. Q. | M. C. | Iden. |
| Blake.....A | 3 | 13 | 16 | 111.5 | 151.5 | 146.5 | 106.0 | 69.5 | 8.5 |
| Blake.....B | 5 | 13 | 18 | 105.0 | 146.0 | 152.0 | 96.0 | 59.5 | 7.5 |
| Leslie.....A | 9 | 5 | 14 | 120.0 | 159.0 | 145.0 | 109.0 | 75.0 | 12.0 |
| Leslie.....B | 10 | 7 | 17 | 110.0 | 151.0 | 143.0 | 102.0 | 77.0 | 12.0 |
| Magnolia....A | 15 | 1 | 16 | 119.5 | 158.5 | 145.0 | 109.5 | 90.5 | 16.0 |
| Magnolia....B | 7 | 9 | 16 | 117.0 | 155.0 | 144.5 | 105.5 | 77.0 | 13.0 |
| All sections.... | 49 | 48 | 97 | 116.5 | 155.0 | 146.0 | 105.0 | 75.1 | 12.4 |

TABLE 8

SEVENTH-GRADE MEDIANS FOR NATIONAL INTELLIGENCE, MULTIPLE CHOICE, AND IDENTIFICATION TEST SCORES, AND FOR SUPPLEMENTARY ITEMS, BY SCHOOLS AND SECTIONS

| School and Section | SEX | | | MEDIANS | | | | | |
|--------------------|------|-------|-------|-----------------|-------|-------|-------|-------|-------|
| | Boys | Girls | Total | Natl. Int. Test | M. A. | C. A. | I. Q. | M. C. | Iden. |
| Blake.....A | 4 | 13 | 17 | 120.0 | 159.0 | 160.0 | 99.0 | 79.0 | 14.0 |
| Blake.....B | 6 | 11 | 17 | 116.0 | 156.0 | 156.0 | 100.0 | 82.0 | 14.0 |
| Leslie.....A | 7 | 10 | 17 | 119.5 | 158.5 | 160.0 | 100.5 | 73.0 | 10.0 |
| Leslie.....B | 9 | 7 | 16 | 117.0 | 156.0 | 160.0 | 96.5 | 83.5 | 12.0 |
| Magnolia....A | 6 | 8 | 14 | 130.0 | 169.0 | 157.0 | 106.0 | 96.5 | 17.0 |
| Magnolia....B | 8 | 8 | 16 | 131.5 | 170.5 | 158.0 | 106.5 | 89.0 | 13.0 |
| All sections.... | 40 | 57 | 97 | 122.0 | 165.0 | 159.0 | 101.0 | 83.5 | 13.3 |

essentially the same as those employed with reference to the multiple choice test previously described. The supplementary multiple choice test was administered during the first two weeks of December, 1937, to 400 children, 100 in each of Grades IV, V, VI, VII. These children were pupils in Blake, Connie Maxwell, and Leslie schools units in the public school system of Greenwood, South Carolina. The children are accepted as representing a fair sample of their respective grades.

Data from the supplementary multiple choice test are reported in the section of this study beginning on page 55.

CHAPTER III

FACTORS INVOLVED IN GROWTH

The preceding chapters have been devoted to a statement of the problem to be investigated and to a description of the conditions under which data were collected. In the present chapter the data will be presented for the purpose of pointing out some of the factors which condition growth in understanding of geographic terms.

Growth in understanding may be thought of as resulting from an increase either in the number of terms whose meanings are known or in the number of meanings known for individual terms. Both types of growth are studied, but for the purpose of this investigation growth through increase in the number of individual terms whose meanings are known is considered the more significant; consequently, a major portion of the findings relates to growth in this sense.

GENERAL COURSE OF DEVELOPMENT

Medians derived from total scores made on the multiple choice, identification, and concrete material tests indicate the general course of growth in understanding of geographic terms. These medians are presented in Table 9. There are two sets of medians for the multiple

TABLE 9
MEDIAN DERIVED FROM TOTAL SCORES MADE ON MULTIPLE CHOICE,
IDENTIFICATION, AND CONCRETE MATERIAL TESTS

| Type of Test | Maximum score possible | MEDIAN BY GRADES* | | | |
|----------------------------------|------------------------------|-------------------|------|------|------|
| | | IV | V | VI | VII |
| Multiple choice (135 terms)..... | 135 | 52.4 | 61.2 | 75.1 | 83.5 |
| Multiple choice (17 terms)..... | 17 | 8.2 | 8.2 | 9.9 | 11.4 |
| Identification..... | 17 | 8.0 | 9.9 | 12.4 | 13.3 |
| Concrete material..... | 17 | 12.3 | 11.0 | 10.5 | 13.0 |

*The medians for all tests except the concrete material test are based upon 97-99 scores per grade; the medians for the concrete material test, upon 8 scores in Grade IV, 14 in Grade V, 17 in Grade VI, and 22 in Grade VII.

choice test—one set for the scores made on the whole 135 terms of the test, and the other for the scores made on the 17 terms common to the multiple choice, identification, and concrete material tests. In order to make comparisons possible, all medians are transmuted into per cents of total possible scores and are presented in Table 10.

TABLE 10
 MEDIAN DERIVED FROM TOTAL SCORES MADE ON MULTIPLE CHOICE, IDENTIFICATION, AND CONCRETE MATERIAL TESTS EXPRESSED AS PER CENTS OF MAXIMUM POSSIBLE SCORES

| Type of Test | Maximum score possible | MEDIAN BY GRADES | | | |
|----------------------------------|------------------------|------------------|------|------|------|
| | | IV | V | VI | VII |
| Multiple choice (135 terms)..... | 135 | 31.3 | 45.3 | 55.6 | 61.9 |
| Multiple choice (17 terms)..... | 17 | 48.2 | 48.2 | 58.2 | 67.1 |
| Identification..... | 17 | 47.1 | 58.2 | 72.9 | 78.2 |
| Concrete material..... | 17 | 72.4 | 64.7 | 61.8 | 76.5 |

Growth curves based on the medians are shown in Figure 1.

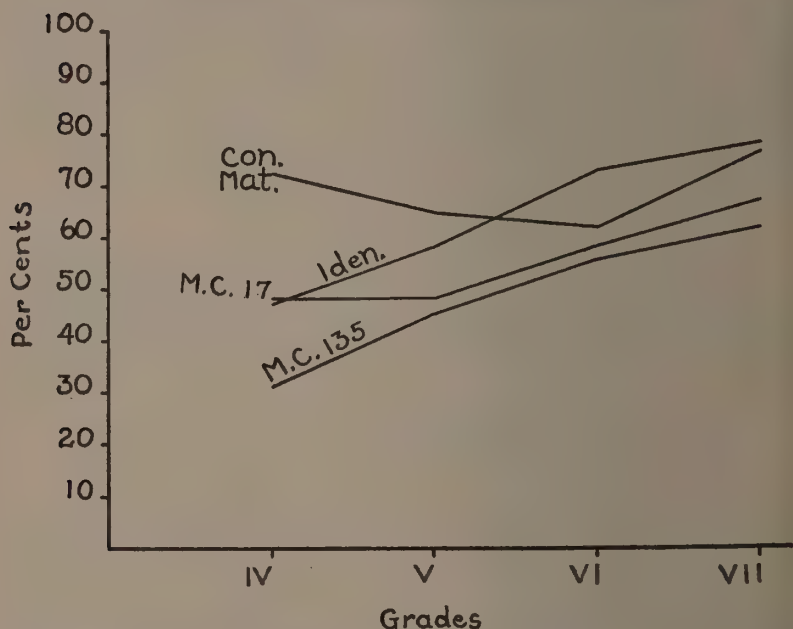


FIG. 1. Growth curves (all terms) based on medians derived from total scores made on multiple choice, identification, and concrete material tests.

FACTORS CONDITIONING GROWTH

One of the obvious facts apparent in Figure 1 is that the four growth curves do not coincide. The curves show that the subjects had greater success in responding to the seventeen terms of the concrete material test than they did to the same terms on the identification and multiple choice tests, and greater success on the identification test than on the seventeen-item multiple choice test. The fact that the

curves do not coincide requires an explanation. Ordinarily, in investigations similar to this one, growth is represented by a single curve. But here there are four curves, each purporting to represent growth. Which of the curves, if any, is the correct one? Is it possible that growth cannot be represented adequately by a single curve? May it not be possible that *all four curves* are equally valid pictures of growth, but of growth conditioned in various ways?

The data of this investigation show that growth of understanding is affected by at least five factors. These factors will be discussed in succeeding sections.

CONDITIONING FACTORS 1 AND 2. AMOUNT AND KIND OF EXPERIENCE

It will be recalled that the seventeen terms common to the multiple choice, identification, and concrete material tests had occurred in the material studied in all of the grades. The data of Table 11 indicate the success with which five children met the requirements of the different tests. The children in Table 11 were fourth-grade pupils

TABLE 11
NUMBER OF TESTS—MULTIPLE CHOICE, IDENTIFICATION, AND CONCRETE
MATERIAL—ON WHICH FIVE FOURTH-GRADE CHILDREN
RESPONDED CORRECTLY

| Subject | TERMS | | | | | | | | | | | | | | | | |
|------------|------------------|---------------|-----|-------|---------|--------|------|----------|---------------|------------|----------|-----------|-------|------------|--------|---------------|------------------|
| | Antarctic circle | Arctic circle | Bay | Coast | Equator | Island | Lake | Meridian | Mouth (river) | North pole | Parallel | Peninsula | River | South pole | Strait | Tropic Cancer | Tropic Capricorn |
| No. 1..... | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 1 | 2 | 2 |
| No. 2..... | 2 | 2 | 1 | .... | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 3 | 3 |
| No. 3..... | 1 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | .... | 1 | 3 | 2 | 2 | 1 | 3 | 2 |
| No. 4..... | 1 | 2 | 2 | 2 | 3 | 3 | 2 | .... | 2 | 3 | .... | 3 | 2 | 2 | 1 | 3 | 3 |
| No. 5..... | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | 2 | 3 | 3 | .... | .... | 1 |

who made the highest scores on the concrete material test. The table is read as follows: Subject No. 1 responded correctly to *antarctic circle* on all 3 tests, to *arctic circle* on 2 tests, to *bay* on 2 tests, and to *coast* on 2 tests, and so on. An examination of Table 11 shows that Subject No. 1 responded correctly to eight terms on all three tests, to eight terms on two tests, and to one term (*strait*) on one of the tests. Corresponding data appear in the table for the other four subjects.

We have two facts then: (1) three different curves of growth based on the seventeen terms common to the three tests (Figure 1) and (2) evidence that a child may know a term when presented in one

test but not when presented in another. How are these two facts to be brought together?

We may think of growth of understanding, as applied to these terms, as a single function. Then, in this sense, a child understands a term or he does not. If this view of understanding is held, the discrepancies in the three growth curves are to be thought of as merely reflecting inadequacies in the measuring instruments. If the tests had actually measured understanding, it would be argued that the three resulting curves should have coincided.

The writer takes a different view of the matter. It is his opinion that understanding is a relative term. Specifically, the understanding of *coast*, for example, may be much or little, depending on the number of ways in which the term is known. According to this view the three different methods of testing employed really measured three different ways of knowing each term. The multiple choice test measured the ability to recognize the meaning of a term among the verbal alternatives given; this is one aspect of understanding, or one kind of understanding, or one part of understanding. The identification test measured another aspect of understanding, namely, the ability to recognize a graphical representation of the thing for which the term stood. The concrete material test measured still another aspect of understanding, namely, the ability to recognize a thing for which the term stands when that thing is presented in tri-dimensional form, that is, by means of a model and a globe.

If this latter view is the correct one, then (1) the curves in Figure 1 are *all* correct and valid; and (2) understanding must be thought of as developing over a number of different avenues, rather than over a single course.

Up to this point the present section has dealt with the fact that children respond with unlike success to the same terms when presented in different types of test. The discussion is now directed to a consideration of the success with which children respond at successive grade levels to individual terms.

The two multiple choice tests represented by the curves of Figure 1 measure the same aspect of growth; that is, they both measure the ability to recognize given meanings of terms when verbally stated. The curves do not, however, coincide. There is a marked difference in the levels of the two multiple choice test curves at the fourth-grade ordinate,¹ as compared with the smaller differences at the fifth-

¹ The difference in level at the fourth-grade ordinate is emphasized, and not the smaller differences at the other ordinates, because these smaller differences

sixth-, and seventh-grade ordinates. How is this difference in level to be explained?

The most obvious difference apparent in the two multiple choice tests is in the number of terms. It is possible that the additional terms in the longer test are more difficult terms than the ones which are common to the two tests. If such is the case, then the differences in the relative difficulty of the terms of the two tests can account for the differences in the two curves.

In order to study the relationship between growth in understanding and differences in the relative difficulty of terms, it is necessary to have some index of difficulty. A convenient index is the per cent of children who respond correctly to a term. Since per cents of the children who responded correctly to a term were different on the various tests, an index based on the composite results of the three tests seemed to offer a more reliable measure of relative difficulty. Accordingly, the per cents of children who responded correctly to each of the seventeen terms common to the multiple choice, identification, and concrete material tests were averaged. Table 12 reports by grades the average per cents of children who responded correctly to

TABLE 12
AVERAGE PER CENTS OF CHILDREN WHO RESPONDED CORRECTLY TO FIVE TERMS
COMMON TO MULTIPLE CHOICE, IDENTIFICATION, AND
CONCRETE MATERIAL TESTS

| Grade | N | Terms | | | | |
|----------|----|-------|---------|------|-------|--------|
| | | Coast | Equator | Lake | River | Strait |
| IV..... | 8 | 42 | 92 | 75 | 67 | 27 |
| V..... | 14 | 60 | 68 | 95 | 95 | 54 |
| VI..... | 17 | 67 | 84 | 78 | 98 | 58 |
| VII..... | 22 | 61 | 91 | 91 | 96 | 67 |

five of the terms, namely, *coast*, *equator*, *lake*, *river*, and *strait*. Thus, 8 children in Grade IV were tested on all three tests: the multiple choice, identification, and concrete material tests. On the average, the per cents of these children who responded correctly to *coast*, *equator*, *lake*, *river*, and *strait* were 42, 92, 75, 67, and 27, respectively.² Figure 2 shows the growth curves for each of the terms.

may be accounted for in the following manner. The two tests contained a differing proportion of terms for which correct definitions did not occur among the alternatives. In the case of the 135-item test there were 21 such terms. In the case of the 17-item test there were only two terms of this kind.

²The differences in the per cents reported in Table 11 cannot be attributed to unreliability occasioned by the limited number of cases involved (the number

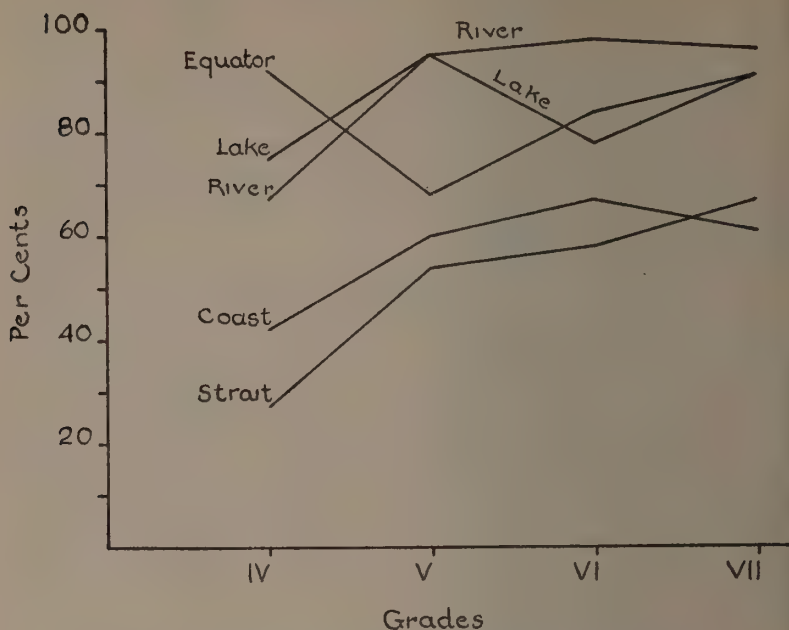


FIG. 2. Growth curves (based on averages) for five terms: *coast, equator, lake, river, and strait.*

All of the terms in Table 12 occurred in the textbook material studied in all four grades. The fact that they did occur means that all of the children had had some opportunity to learn their meanings. The important fact about Table 12 and Figure 2 is that the growth patterns of the different terms vary markedly. The significance of these differences is that they represent varying degrees of learning at the successive grade levels.

In this section, data have been presented which show (1) that children respond with unlike success to the same terms when presented in different types of test and (2) that at successive grade levels children respond with unlike success to terms which in all grades they have had some opportunity to learn.

Since learning is basically experience, the differences referred to in the preceding paragraph represent varying or unlike experiences with the several terms. To what extent these unequal and unlike

of cases in Grades IV, V, VI, and VII were 8, 14, 17, and 22 respectively). Attention is called to the fact that similar means based on the results of only two of the tests, the multiple choice and identification, showed the same kind of differences as those reported in Table 12. Since these two tests were administered to approximately 100 pupils in each grade the data must surely be reliable.

experiences are due (1) to differences in incidental opportunities to learn, in emphasis in instruction, or in both, and to what extent they are due (2) to differences in mental maturity requisite to certain kinds of experience, cannot be determined from the data at hand. Perhaps the differences in degrees of learning are due to *both* types of experience variables referred to; at least so the data of Tables 11 and 12 are here interpreted. The amount and kind of experience which children have had with terms are taken as the first and second factors which condition growth in understanding.

CONDITIONING FACTOR 3. LEVEL OF GEOGRAPHIC ATTAINMENT

The data derived from the multiple choice, identification, and concrete material tests showed that for each of the tests there were relatively large differences in the size of the total scores. For example, the scores in Grade IV varied from 18 to 86 on the multiple choice test (135 terms), from 0 to 16 on the identification test, and from 5 to 16 on the concrete material test. Similar variations existed in Grades V, VI, and VII. These facts suggested the hypothesis that different growth curves might be expected for different kinds of pupils—those that knew the terms well, those that knew them somewhat less well, and those that knew them very imperfectly.

In order to test this hypothesis, the pupils of each grade were divided on the basis of total multiple choice test (135 terms) scores into three "attainment groups" approximately equal in size. The groups making the highest, intermediate, and lowest scores are here designated as group 3, group 2, and group 1, respectively. Table 13 shows the number of children in each group and the range of scores made on the multiple choice test.

TABE 13

NUMBER OF CHILDREN IN EACH OF THE THREE ATTAINMENT GROUPS INTO WHICH GRADES WERE DIVIDED, AND RANGE OF SCORES MADE ON MULTIPLE CHOICE TEST (135 TERMS)

| | GRADE IV | | GRADE V | | GRADE VI | | GRADE VII | |
|--------------------|-----------|-------|-----------|--------|-----------|--------|-----------|--------|
| | No. Cases | Range | No. Cases | Range | No. Cases | Range | No. Cases | Range |
| Group 3..... | 31 | 60-86 | 31 | 70-108 | 32 | 84-110 | 31 | 94-118 |
| Group 2..... | 36 | 46-59 | 35 | 55-69 | 33 | 68-83 | 34 | 76-93 |
| Group 1..... | 31 | 18-45 | 33 | 28-54 | 32 | 39-65 | 32 | 44-75 |
| <i>Total</i> | 98 | 18-86 | 99 | 28-108 | 97 | 39-110 | 97 | 44-118 |

Table 14 contains a sample of four terms (all of them common to the material studied by all four grades) and the per cents of children in each attainment group who responded correctly on the multiple

TABLE 14
PER CENTS OF CHILDREN WHO RESPONDED CORRECTLY ON MULTIPLE CHOICE
TEST TO FOUR TERMS WHICH WERE COMMON TO MATERIAL STUDIED BY
ALL GRADES, BY GRADES AND GROUPS

| Terms | GRADES | | | |
|---------------|--------|-------|-------|-------|
| | IV | V | VI | VII |
| <i>Inland</i> | | | | |
| Group 3* | 41.9 | 77.4 | 93.7 | 96.8 |
| Group 2 | 25.0 | 54.3 | 57.6 | 73.5 |
| Group 1 | 0.0 | 18.2 | 46.9 | 43.8 |
| <i>Island</i> | | | | |
| Group 3 | 90.3 | 93.5 | 100.0 | 90.3 |
| Group 2 | 72.2 | 80.0 | 84.8 | 97.1 |
| Group 1 | 48.4 | 69.7 | 59.4 | 81.3 |
| <i>Lake</i> | | | | |
| Group 3 | 77.4 | 100.0 | 93.7 | 100.0 |
| Group 2 | 72.2 | 88.6 | 66.7 | 94.1 |
| Group 1 | 51.6 | 48.5 | 65.6 | 75.0 |
| <i>River</i> | | | | |
| Group 3 | 87.1 | 100.0 | 100.0 | 96.8 |
| Group 2 | 97.2 | 91.4 | 100.0 | 100.0 |
| Group 1 | 77.4 | 81.8 | 96.9 | 100.0 |

*The numbers of children in the three groups for Grade IV were 31, 36, and 31; for Grade V, 31, 35, and 33; for Grade VI, 32, 33, and 32; for Grade VII, 31, 34, and 32.

choice test. It will be seen, for example, that the per cents of fourth-grade children in group 3, group 2, and group 1 who responded correctly to *inland* were 41.9, 25.0, and 0.0, respectively.

Growth curves for each of the terms of Table 14 are shown in Figure 3. These curves, together with the data of Table 14, reveal strikingly the relationships between level of geographic attainment and growth in understanding—(1) growth in understanding of a specific term is not the same for the three levels of attainment, and (2) the differences in growth at the several levels are not uniform in amount for all terms. Level of attainment is, then, a third factor conditioning growth in understanding.

CONDITIONING FACTOR 4. WAYS IN WHICH MEANINGS ARE VERBALIZED

As was stated in the discussion of the construction of the multiple choice test, six alternatives were offered with each term of the test, the sixth alternative being "I think it means. . . ." The purpose of the sixth alternative was to give children who thought that they knew

the meaning of a term, but who did not recognize its meaning in the given definitions, an opportunity to define the term. For 21 of the 135 terms correct definitions were not included among the alternatives. There were thus 114 terms for which number-six answers were *not* required, correct definitions already having been supplied.

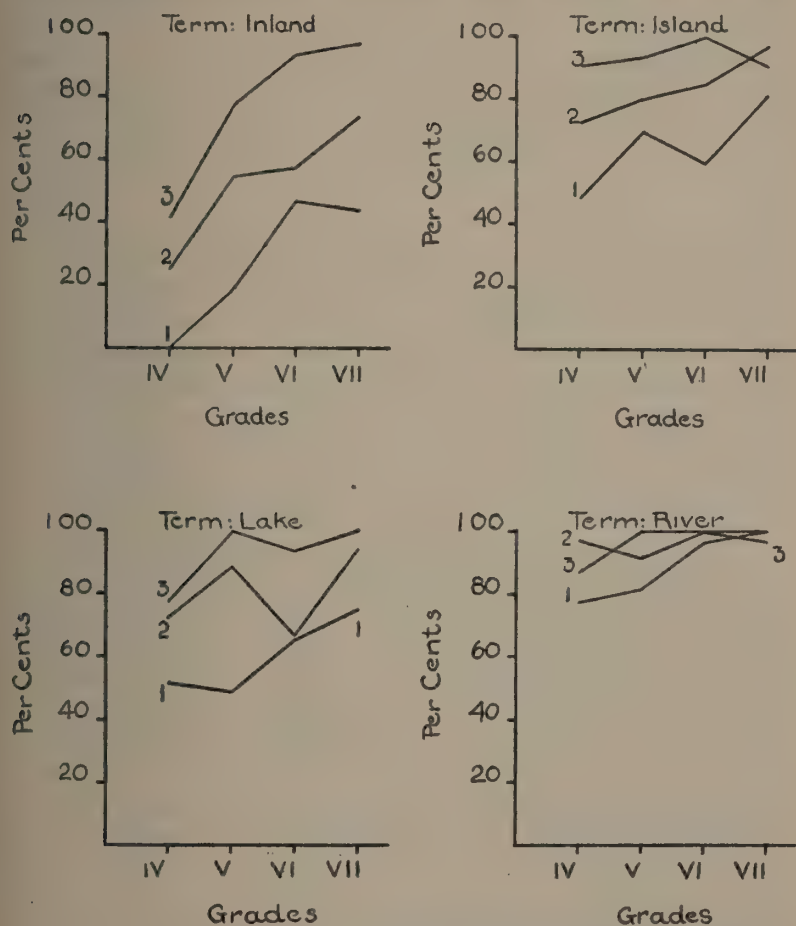


FIG. 3. Growth curves for three attainment groups (see Table 14).
Terms: *Inland, Island, Lake, and River.*

An examination of the responses made to these 114 terms showed that many children had responded needlessly with number-six answers. That is, they had written in definitions when satisfactory definitions were at hand among the first four alternatives. What is

the significance of this fact? Why did the children respond to terms by stating definitions of their own when they were already provided with good definitions? The fact that a meaning may be verbally expressed in different ways is a cue to one plausible answer. The children gave original definitions because they had not verbalized the meanings of the terms in the manner of the definitions offered among the alternatives.

A comprehensive understanding of the meanings of a term depends partially upon verbalization of its meanings in many different ways. Growth in understanding is, then, conditioned by the number of ways in which the meanings of a term are verbalized (Factor 4).

CONDITIONING FACTOR 5. MENTAL AGE

As was suggested in the discussion of "Conditioning Factors 1 and 2. Amount and Kind of Experience" (p. 33), the capacity for having certain kinds of experience is dependent in part upon mental maturity. For example, it *may* be that the experiences necessary for the development of acceptable meanings for *river* can be had by a child who has the mental maturity of a normal six-year old, but that the experiences necessary for the development of acceptable meanings for *longitude* cannot be had by a child who has a mental maturity less than that of a normal twelve-year old.

In order to determine if a relationship does exist between mental maturity and the development of meanings, a comparison was made by grades and groups³ of the mean mental ages and the mean multiple choice and identification test scores. (A comparison was not made between mental ages and concrete material test scores for the reason that in most instances the number of subjects per group was quite limited.) Mean mental ages and mean test scores are listed in Table 15.

An examination of Table 15 reveals, without a single exception, that within a grade an increase in mental age is accompanied by an increase in the total scores made on the tests. For example, in Grade IV, as the mean mental age (in months) increases steadily from 124.2 in group 1 to 140.4 in group 3, the mean multiple choice test score increases steadily from 35.7 to 69.5. At the same time the mean identification test score increases steadily from 6.3 to 10.3.

Plainly mental age is a factor which conditions growth in understanding (Factor 5).

³ The groups were the same as those reported in the discussion of *Conditioning Factor 3. Level of Geographic Attainment* (p. 37).

TABLE 15
MEAN MENTAL AGES AND MEAN MULTIPLE CHOICE (135 TERMS) AND
IDENTIFICATION TEST SCORES, BY GRADES AND GROUPS

| Grades and Groups | N* | M. A. in Months | M. C. | Iden. |
|-------------------|----|-----------------|-------|-------|
| GRADE IV | | | | |
| Group 3..... | 30 | 140.4 | 69.5 | 10.3 |
| Group 2..... | 34 | 131.6 | 52.4 | 8.5 |
| Group 1..... | 27 | 124.2 | 35.7 | 6.3 |
| GRADE V | | | | |
| Group 3..... | 30 | 153.6 | 81.3 | 11.5 |
| Group 2..... | 35 | 146.1 | 62.2 | 9.7 |
| Group 1..... | 32 | 136.9 | 42.1 | 5.5 |
| GRADE VI | | | | |
| Group 3..... | 32 | 168.4 | 94.5 | 14.3 |
| Group 2..... | 33 | 156.1 | 74.8 | 11.6 |
| Group 1..... | 31 | 144.9 | 55.0 | 7.1 |
| GRADE VII | | | | |
| Group 3..... | 29 | 173.9 | 103.3 | 15.5 |
| Group 2..... | 33 | 164.5 | 85.1 | 12.5 |
| Group 1..... | 31 | 153.9 | 65.5 | 10.5 |

*The frequencies are not identical with those reported elsewhere in the study for the reason that intelligence test scores for a few of the subjects were lacking.

CONDITIONING FACTOR 6. SEX

Boys and girls have different interests and engage in different activities. More specifically, for example, they read different types of literature and go to different places. As a consequence of these unlike interests and activities, boys and girls have unlike experiences. It is a reasonable hypothesis that these unlike experiences may be reflected in the scholastic achievements of the two sexes.

Table 16 reports by grades and groups⁴ the mean mental ages and the mean total multiple choice test scores of boys and girls. Table 16 is read as follows: There were 19 boys in group 3 of Grade IV. Their mean mental age was 140.7 months and their mean multiple choice test score 70.4. There were 11 girls in group 3 of Grade IV, with a mean mental age of 139.8 months and a mean multiple choice test score of 67.9. The data in Table 16 seem to suggest that there is a sex factor in favor of the boys. Thus, in group 3 of Grade V, for example, the mean mental age of the boys is two months less than that of the girls but their mean multiple choice test score is 5.3 points higher. In group 1 of Grade VI the mean mental age of the boys is only five-tenths of a month higher than that of the girls, but their mean multiple choice test score is 6.2 points higher. In group 1 of Grade VII the mean mental age of the boys is 7.7

⁴ The groups were the same as those reported in the discussion of *Conditioning Factor 3. Level of Geographic Attainment* (p. 37).

TABLE 16
MEAN MENTAL AGES AND MEAN MULTIPLE CHOICE TEST SCORES OF BOYS AND
GIRLS, BY GRADES AND GROUPS

| Grades and Groups | SEX | | | | | |
|---------------------|------|--------------------|-------|-------|--------------------|-------|
| | Boys | | | Girls | | |
| | N* | M. A. in Months | M. C. | N | M. A. in Months | M. C. |
| GRADE IV | | | | | | |
| Group 3 | 19 | 140.7 | 70.4 | 11 | 139.8 | 67.9 |
| Group 1 | 9 | 117.3 | 37.4 | 18 | 127.6 | 35.9 |
| Groups 3 and 1..... | 28 | 133.2 | 59.8 | 29 | 132.2 | 48.1 |
| GRADE V | | | | | | |
| Group 3 | 23 | 153.1 | 82.6 | 7 | 155.1 | 77.3 |
| Group 1 | 10 | 131.1 | 40.9 | 22 | 139.6 | 42.6 |
| Groups 3 and 1..... | 33 | 146.4 | 69.7 | 29 | 143.3 | 60.0 |
| GRADE VI | | | | | | |
| Group 3 | 20 | 164.0 | 95.4 | 12 | 172.4 | 93.1 |
| Group 1 | 10 | 145.2 | 59.2 | 21 | 144.7 | 53.0 |
| Groups 3 and 1..... | 30 | 157.8 | 83.3 | 33 | 154.5 | 67.6 |
| GRADE VII | | | | | | |
| Group 3 | 21 | 169.0 | 102.5 | 8 | 185.5 | 105.5 |
| Group 1 | 7 | 148.6 | 67.6 | 24 | 156.3 | 64.9 |
| Groups 3 and 1..... | 28 | 165.0 | 93.8 | 32 | 163.6 | 75.1 |

*The frequencies are not identical with those reported elsewhere in the study for the reason that intelligence test scores for a few of the subjects were lacking.

months less than that of the girls, but their mean multiple choice test score is 2.7 points higher. In at least ten of the twelve groups, comparisons of mental ages and test scores show that there is a sex factor in favor of the boys. The two groups in which the factor is possibly not present are group 3 of Grade IV and groups 3 and 1 of Grade V. Sex is thus a sixth factor which conditions growth in understanding.

SUMMARY

In this chapter growth curves based on data derived from several tests were presented. Each of these curves pictures a different aspect of growth, and each is offered as a valid representation of the growth function measured by the corresponding test. The fact that the several curves are very dissimilar indicates that growth in understanding cannot be represented adequately by a single curve. The interpretation of the total scores is that, in general, from Grade IV to Grade VII there is growth in understanding of geographic vocabulary.

The data which have been treated in this chapter have been found to reveal at least six factors which condition growth in understanding. They are:

- 1 and 2. Amount and kind of experience.
3. Level of geographic attainment.

4. Ways in which meanings of terms are verbalized.
5. Mental age.
6. Sex.

These six factors are rather closely related. The level of geographic attainment (Factor 3) which has been reached and the manner in which meanings of terms have been verbalized (Factor 4) are both probably dependent upon amount and kind of experience (Factors 1 and 2); on the other hand, the amount and kind of experience which one has is conditioned by both mental age (Factor 5) and sex (Factor 6).

In this chapter some of the facts which relate to growth in understanding have been discussed. These facts are important, but they do not furnish much insight into the nature of the learning responsible for growth in understanding. In order to gain information on this point, a further analysis of the data must be made. This analysis is made in Chapter IV, where some of the principles involved in growth in understanding are developed.

CHAPTER IV

PRINCIPLES OF GROWTH

The data of this investigation show that the growth of meanings proceeds in accordance with several rather clearly defined principles, five of which are developed in the succeeding sections of this chapter.

PRINCIPLE 1. GROWTH PROCEEDS THROUGH AN INCREASE IN THE NUMBER OF DIFFERENT KINDS OF MEANINGS

In connection with "Conditioning Factors 1 and 2. Amount and Kind of Experience" (p. 33) it was pointed out that a child may know a term when presented in one type of test but not when presented in another. More specifically it was suggested that each of the tests—multiple choice, identification, and concrete material—measures a different way of knowing a term and that children may know some terms in several ways and other terms in just one way. How are these facts related to growth in understanding?

In Table 17 the per cents of children who consistently responded correctly on two or more different tests are tabulated by grades. The table is divided into two parts, *A* and *B*. It will be observed (first line, Part A) that 98 children in Grade IV were given both the multiple choice and the identification tests. The per cent of these 98 children who responded correctly on both tests to *antarctic circle* was 5, to *arctic circle* was 33, to *bay* was 7, and to *coast* was 4. The rest of the column and table (Part A) are read in a similar manner.

For the purposes of this discussion the data for Grades IV and VII are the most important. A comparison of the data in columns 1 and 4 of Table 17, Part A, shows that a larger per cent of seventh-grade children than fourth-grade children responded correctly to each of the seventeen terms. Thus the per cents for *antarctic circle* are 21 and 5, for *arctic circle* 51 and 33, for *bay* 20 and 7, and for *coast* 32 and 4. Furthermore, for eight of the seventeen terms there is a steady increase from Grade IV to Grade VII in the per cent of children who responded correctly on *both* the multiple choice and identification tests. The terms are *bay*, *coast*, *island*, *north pole*, *parallel*, *river*, *south pole*, and *strait*.

TABLE 17

PER CENTS OF CHILDREN, BY GRADES, WHO CONSISTENTLY RESPONDED CORRECTLY TO SEVENTEEN TERMS WHICH WERE COMMON (PART A) TO MULTIPLE CHOICE AND IDENTIFICATION TESTS; (PART B) TO MULTIPLE CHOICE, IDENTIFICATION AND CONCRETE MATERIAL TESTS

| Grade..... N..... | PART A M. C. AND IDEN. | | | | PART B M. C., IDEN. AND CON. MAT. | | | |
|--------------------------|---------------------------|----|----|-----|--------------------------------------|----|----|-----|
| | IV | V | VI | VII | IV | V | VI | VII |
| N..... | 98 | 99 | 97 | 97 | 8 | 14 | 17 | 22 |
| Antarctic circle*..... | 5 | 4 | 7 | 21 | 13 | 8 | 12 | 15 |
| Arctic circle..... | 33 | 25 | 38 | 51 | 25 | 17 | 41 | 20 |
| Bay*..... | 7 | 9 | 16 | 20 | 0 | 0 | 12 | 15 |
| Coast..... | 4 | 14 | 23 | 32 | 0 | 7 | 29 | 14 |
| Equator..... | 67 | 43 | 66 | 76 | 75 | 33 | 65 | 71 |
| Island..... | 64 | 75 | 78 | 89 | 63 | 69 | 73 | 86 |
| Lake..... | 40 | 63 | 61 | 74 | 38 | 86 | 59 | 76 |
| Meridian..... | 13 | 5 | 32 | 34 | 0 | 8 | 27 | 36 |
| Mouth (river)..... | 15 | 21 | 20 | 33 | 50 | 43 | 13 | 36 |
| North pole..... | 31 | 39 | 44 | 73 | 43 | 31 | 29 | 67 |
| Parallel..... | 5 | 10 | 19 | 24 | 0 | 25 | 24 | 24 |
| Peninsula..... | 25 | 56 | 52 | 59 | 38 | 57 | 38 | 55 |
| River..... | 28 | 53 | 79 | 80 | 25 | 85 | 94 | 87 |
| South pole..... | 48 | 55 | 60 | 80 | 38 | 38 | 64 | 71 |
| Strait..... | 12 | 22 | 40 | 46 | 0 | 38 | 31 | 45 |
| Tropic of Cancer..... | 42 | 16 | 43 | 53 | 38 | 8 | 25 | 24 |
| Tropic of Capricorn..... | 44 | 15 | 45 | 53 | 25 | 0 | 40 | 25 |

*One of the terms for which a correct definition was not included among the alternatives of the multiple choice test.

The data for Part B of Table 17 support the principle of growth revealed in connection with Part A.¹ When the per cents of successes for Grade IV and Grade VII children are compared, it is seen that there are twelve terms for which the per cents of children who responded correctly on all three tests—multiple choice, identification, and concrete material—are greater in Grade VII than in Grade IV. The five terms for which this condition does not hold are *arctic circle*, *equator*, *mouth*, *tropic of Cancer*, and *tropic of Capricorn*. The data for most of the terms in Part B agree with those in Part A: from Grade IV to Grade VII there is an increase in the per cents of children who know the meanings of these terms in more than one way.

The data of Table 17 are accordingly interpreted to mean that growth in understanding proceeds through an increase in the number of different kinds of meanings (Principle 1).

¹ In Table 17 there are only two terms, *island* and *meridian*, for which there is a steady increase from grade to grade in the per cent of children who responded correctly on each of the three tests, multiple choice, identification, and concrete material. There are seven other terms, however, for which, except at one grade, there is a steady increase in the per cent of children responding correctly. The fact that there are not more terms for which there is a steady increase is attributed to the limited number of children tested.

PRINCIPLE 2. GROWTH PROCEEDS THROUGH AN INCREASE OF
GENERAL INFORMATION

In Chapter II it was stated that two sets of directions were used in obtaining essays. According to one set of directions (plan one) the subjects were told to write only one or two sentences about the meaning of a term. According to the other set of directions (plan two) the subjects were told to write all they knew about the meaning of a term.

In order to determine the number and nature of the meanings which the children had, the essays written according to plan two for eight of the terms, selected at random, were analyzed. A record was made of all the relevant or correct ideas (meanings) which were contained in each of the essays. The terms were *continent*, *equator*, *island*, *ore*, *plateau*, *pole*, *rainfall*, and *raw material*. In Table 18 are given the median number of meanings which the children had for

TABLE 18
MEDIAN NUMBER OF MEANINGS WHICH TEN CHILDREN IN EACH OF GRADES
IV, V, VI, AND VII EXPRESSED IN ESSAYS ON *Eight* GEOGRAPHIC TERMS

| Terms | GRADES | | | |
|-------------------|--------|------|-----|------|
| | IV | V | VI | VII |
| Continent..... | 1.0 | 3.0 | 1.0 | 5.0* |
| Equator..... | 0.0 | 3.0* | 2.5 | 2.5 |
| Island..... | 3.0 | 2.0 | 3.5 | 3.5 |
| Ore..... | 1.0 | 2.0 | 2.0 | 3.0* |
| Plateau..... | 1.0 | 2.0 | 2.0 | 4.0 |
| Pole..... | 3.0 | 4.5 | 4.5 | 5.0* |
| Rainfall..... | 1.5 | 2.5 | 2.5 | 3.5 |
| Raw material..... | 1.0 | 1.0 | 1.5 | 2.0 |

*Sample included nine cases.

these terms. For example, the median number of meanings which ten children of Grades IV, V, VI, and VII expressed in their essays about *continent* was 1, 3, 1, and 5, respectively.

Table 19 begins a series of three tables, each devoted to the frequencies with which various ideas (meanings) were expressed in the essays written about as many different terms. Table 19 is for the term *continent*. Of the ten children in Grade IV who wrote essays on the meanings of *continent*, 2 expressed no meanings (that is, their papers were blank), 6 gave one or more examples of *continent*, 2 expressed the idea of "body of land," 1 the idea of "bigness," 1 the idea that a continent is an "island," and 1 the idea that continents are

TABLE 19

FREQUENCIES WITH WHICH MEANINGS OF *Continent* WERE EXPRESSED IN ESSAYS BY TEN CHILDREN IN EACH OF GRADES IV, V, VI, AND VII

| Grades | MEANINGS OF <i>Continent</i> | | | | | | | | | | | | | | | | |
|-----------|------------------------------|----------------------|--------------|---------|--------|--------------------------------------|------------------|----------------|-------------------|--------------------|--------------------|-----------|-----------------------|--------------------------------|----------------|-----------------------|----------------------------------|
| | No Ideas | One or More Examples | Body of Land | Bigness | Island | Rivers, Lakes, Mountains and Deserts | Irregular Coasts | Six Continents | Largest Continent | Smallest Continent | Of Different Sizes | Inhabited | Composed of Countries | Inhabited by Different Peoples | Miscellaneous† | Total Number of Ideas | Number of <i>Different</i> Ideas |
| IV..... | 2 | 6 | 2 | 1 | 1 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1 | ..... | ..... | 11 | 5 |
| V..... | 2 | 3 | 6 | 7 | .... | 2 | 1 | 3 | 1 | 1 | 1 | 1 | ..... | ..... | ..... | 26 | 10 |
| VI..... | 3 | 7 | 2 | 2 | ..... | 1 | ..... | 1 | ..... | ..... | ..... | 2 | 1 | ..... | ..... | 16 | 7 |
| VII*..... | ..... | 7 | 6 | 2 | ..... | 1 | ..... | 6 | 3 | 4 | 3 | 4 | 2 | 3 | 5 | 46 | 16 |

*Nine cases only.

†Includes one case each of "identification with hemispheres," "North America discovered by Columbus," "Possess different climates," "separated by water," and "North and South America separated by Panama Canal."

"composed of countries"—a total of eleven ideas, representing five *different* ideas for fourth-grade children whose essays were studied.

Certain interesting facts should be noted from Table 19. For example, of the eight fourth-grade children who expressed ideas about *continent*, six cited one or more examples of continents. Only four other different ideas were expressed, and only one of these, "body of land," was expressed by as many as two children. Of all the ideas mentioned, only three, "examples," "body of land," and "bigness," occurred in the essays from each of the grades. Special attention is directed to the fact that the nine seventh-grade children expressed *over four times as many ideas* as the ten fourth-grade children (46 compared with 11) and *over three times as many different ideas* (16 compared with 5).

The frequencies with which various ideas (meanings) were expressed in the essays written about *rainfall* are given in Table 20. The children of all grades expressed the ideas of "rain," "light or heavy rain," and "differences in rainfall" in their essays on *rainfall*. With the exception of "rain," only *one* idea, "amount of rain" (for example, 60 inches), was expressed by as many as five (Grade VII) of the children. Seventh-grade children expressed *over twice as many ideas* as did fourth-grade children (36 compared with 13), and *over three times as many different ideas* (13 compared with 4).

number of *different* ideas expressed. Most of these ideas are perhaps essential to a well-rounded understanding of the meanings of the terms in question. They are of the type commonly thought of as general information. The data which have been presented in Tables 19, 20, 21 are therefore interpreted to mean that growth in understanding proceeds through an increase of general information (Principle 2).

PRINCIPLE 3. GROWTH PROCEEDS THROUGH A SUBSTITUTION OF BASIC FOR ASSOCIATED MEANINGS

It has been suggested that many of the meanings which children have for geographic terms represent general, but not crucial, information. Such meanings may be thought of as *associated* meanings. In contradistinction, there are other meanings which are crucial or vital to the formulation of correct definitions. Meanings of this type are here designated as *basic* meanings.

Associated meanings are sometimes learned as basic meanings. A good illustration of such a case is found in the meanings which some children were found to have for *natives*.

Meanings for natives. Ten essays about *natives* (collected according to plan one) were selected from those written by fourth-grade children. The ten complete essays, corrected for spelling and grammar, are reproduced below.

- a. They are people who were born in a place and still live there.
- b. Are dark skinned people who live in the Belgian Congo in the continent of Africa.
- c. Natives are people who are called the black race. They live in the forest of Africa.
- d. Natives are people who live in Africa and other places.
- e. In Africa are some natives.
- f. Natives are a black race of people who live in Africa.
- g. The Congo natives live in the Belgian Congo where it is hot. They wear very thin (clothes).*
- h. A black race of people that live in Africa.
- i. A native is a person who lives in a foreign country like Africa.
- j. A black race of people that live in Africa.

Only one of the ten essays, the first, expresses the basic meaning of *natives*, namely, the idea of "people who were born in certain places." The remaining nine essays contain only associated meanings. For example, the second essay, b, states that natives are "dark skinned people" and that they "live in the Belgian Congo in the continent of

* Parentheses and content supplied by the writer.

Africa." Many natives are of course dark skinned and many of them do live in Africa, but these facts are not basic to the essential meaning of *natives*.

Twenty essays written on *natives* by seventh-grade children according to plan one are available for comparison with the fourth-grade essays. Nine of the meanings given, corrected for spelling and punctuation, are reproduced below.

Basic meanings.

- a. Natives are people who live in the country where they were born.
- b. Natives means persons who were born here. Natives means wild men from Africa.

Doubtful.

- a. Natives means the people of their country.
- b. Natives means the people who live in the city where you were born.
- c. There are natives in this town where we live.

Associated meanings. (samples)

- a. A group of people who are something like negroes.
- b. Natives are uncivilized people who worship gods.
- c. Natives are black people who are wild and uncivilized.
- d. Natives are people who are not in a city.

Of the twenty seventh-grade children who wrote essays about *natives*, two stated basic meanings, three meanings which might be considered basic ones, and fifteen associated meanings only.

Natives is not the only term for which associated rather than basic meanings had been learned. For example, the essays on *west coast*, which are next considered, show the same phenomenon.

Meanings for west coast. Ten essays were written (plan one) by fourth-grade children about *west coast*. Three of the essays were blank. The other seven complete essays are reproduced below:

- a. It is a fishing port near the coast of Norway.
- b. A coast is where ships load and unload.
- c. The west coast of Norway.
- d. The west coast of Norway is rocky and hilly.
- e. A coast is like the coast of Norway where ships load and unload.
- f. A coast is a place ships land and you can go swimming on the coast.
- g. A west coast is the shore of a river where it is frozen.

None of the essays contain the basic meanings of *west coast*. Whether the meanings actually represented are properly to be designated as associated meanings may well be questioned. It might be noted, however, that in three of the essays, b, e, and f, the children

did associate *coast* with *ships*; yet certainly the *basic* meaning of *coast* is quite unrelated to *ships* or to anything which pertains to them.

The fact that "Norway" is mentioned in four of the seven essays probably reflects merely the effect of a recent study of that country. The frequency with which "Norway" is mentioned is therefore not considered significant for present purposes.

Twenty essays (plan one) were written by seventh-grade children about *west coast*. One essay was blank. The remaining nineteen essays showed that the children had a wide variety of meanings for the term. Samples of the complete essays follow:

- a. The word west coast (means the coast)* which is in the western part of the country. The west coast of the United States is the coast of the Pacific Ocean.
- b. West coast means a coast which the Pacific Ocean runs up on.
- c. West coast means the direction of a coast.
- d. West coast is the west side to the ocean in any country.
- e. The west coast is the coast in the west.
- f. The west coast is the western part of a country where land and sea meet.
- g. A coast is the bank on the edge of an ocean or sea. A west coast is the coast on the west side of an ocean.
- h. The coast is a place where shipping is carried on. The coast is at the edge of the ocean.
- i. The west coast of the United States is on the Pacific Ocean.
- j. The west coast is the coast of the Pacific Ocean.

In two of the seventh-grade essays (b and j) *west coast* is identified with the Pacific Ocean. Apparently the children who wrote these essays thought that any coast which touched the Pacific Ocean was a *west coast*. It can of course be maintained that the children who wrote essays b and j were thinking specifically of North and South America. The responses which were made on the multiple choice test, however, do not bear out this contention. Table 22 reports the per cents of children who responded to each of the alternatives which were offered with *west coast*; from 16 to 21 per cent of the children in each grade selected the first alternative, "The coast which is next to the Pacific Ocean," in spite of the fact that the item read, "The west coast of any country means"; and in spite of the further fact that one of the alternatives, the second, was "The coast which is on the west side of the country." None of the other definitions, except the correct one, were selected by more than 3.1 per cent of the children.

* Parentheses and content supplied by the writer.

TABLE 22
PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
West Coast, BY GRADES

| Alternatives | GRADES | | | |
|--|----------------|---------------|----------------|-----------------|
| | IV (N = 98) | V (N = 99) | VI (N = 97) | VII (N = 97) |
| The <i>west coast</i> of any country means: | | | | |
| 1. The coast which is next to the Pacific Ocean..... | 21.4 | 16.2 | 16.5 | 16.5 |
| 2. The coast which is on the west side of the country..... | 54.1 | 72.7 | 73.2 | 80.4 |
| 3. The warmest side of the country..... | 1.0 | 1.0 | 2.1 | 0.0 |
| 4. The side of the country where most of the people live..... | 3.1 | 0.0 | 0.0 | 0.0 |
| 5. I don't know..... | 18.4 | 6.1 | 4.1 | 1.0 |
| 6. I think it means..... | 1.0 | 3.0 | 3.1 | 0.0 |
| 7. Omitted..... | 1.0 | 0.0 | 1.0 | 1.0 |
| 8. Ambiguous..... | 0.0 | 1.0 | 0.0 | 1.0 |

The data from the essays and from the multiple choice test reported in the foregoing treatment have been presented and discussed at some length in order to establish the fact that the learning of associated meanings in place of basic meanings is a very real occurrence. Additional data from the multiple choice test are now presented in order to show how the learning of associated for basic meanings is related to growth in understanding.

Data from multiple choice test. The per cents of children who responded to the alternatives offered with *capital* are found in Table 23. (The frequencies by grades for this table, as well as for Tables 24-28, are the same as those in Table 22.) Several facts should be noted in Table 23. The first is that alternative 1 expresses an associated meaning of *capital*. Frequently, perhaps in a majority of cases,

TABLE 23
PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
Capital, BY GRADES

| Alternatives | GRADES | | | |
|---|--------|------|------|------|
| | IV | V | VI | VII |
| The <i>capital</i> of a country means: | | | | |
| 1. The largest city of the country..... | 27.6 | 12.1 | 16.5 | 7.2 |
| 2. The city where most of the government work is done..... | 41.8 | 63.6 | 61.9 | 85.6 |
| 3. The city which is nearest the middle of the country..... | 7.1 | 12.1 | 13.4 | 4.1 |
| 4. The chief seaport of the country..... | 2.0 | 1.0 | 0.0 | 2.1 |
| 5. I don't know..... | 11.2 | 4.0 | 0.0 | 1.0 |
| 6. I think it means..... | 6.1 | 7.1 | 8.2 | 0.0 |
| 7. Omitted..... | 4.1 | 0.0 | 0.0 | 0.0 |
| 8. Ambiguous..... | 0.0 | 0.0 | 0.0 | 0.0 |

the capital of a country is "the largest city of the country," but this meaning of *capital* is plainly not the basic one. A second fact to be noted is that over 25 per cent of the fourth-grade children selected alternative 1 as the meaning of *capital*. A third fact, and the most important one, is that as the per cents of children who responded correctly (alternative 2) increased from Grade IV to Grade VII (41.8 to 85.6) the per cents of children who responded to the associated meaning (alternative 1) decreased correspondingly (27.6 to 7.2).

A similar analysis of the answers for *east wind* is given in Table 24. The first alternative, "a warm wind," is one of the associated

TABLE 24

PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
East Wind, BY GRADES

| Alternatives | GRADES | | | |
|--|--------|------|------|------|
| | IV | V | VI | VII |
| <i>An east wind means:</i> | | | | |
| 1. A warm wind..... | 14.3 | 5.1 | 6.2 | 0.0 |
| 2. A strong wind..... | 5.1 | 3.0 | 1.0 | 1.0 |
| 3. A wind which blows from the east..... | 65.3 | 85.9 | 89.7 | 89.7 |
| 4. A wind which blows toward the east..... | 7.1 | 4.0 | 1.0 | 3.1 |
| 5. I don't know..... | 6.1 | 2.0 | 0.0 | 5.2 |
| 6. I think it means..... | 0.0 | 0.0 | 1.0 | 0.0 |
| 7. Omitted..... | 2.0 | 0.0 | 1.0 | 0.0 |
| 8. Ambiguous..... | 0.0 | 0.0 | 0.0 | 1.0 |

meanings of an *east wind*. In the fourth grade the per cent of children who responded to this definition was 14.3. In the fifth, sixth, and seventh grades the per cents were 5.1, 6.2, and 0.0, respectively. As the per cents of children who responded to alternative 1 *decreased* the per cents of children who responded correctly (alternative 3) *increased* from 65.3 in Grade IV to 89.7 in Grade VII. Table 24 shows, just as Table 23 did, that an increase in the per cent of children who responded to the basic meaning is accompanied by a decrease in the per cent of children who responded to an *associated* meaning.

In the case of *horizon* (Table 25) approximately 25 per cent of the children in all grades selected alternative 1, "The colors in the sky which can be seen just after the sun sets." In only one instance was either of the two remaining incorrect alternatives responded to by as many as 3.1 per cent of the children.

Here we have a case in which there is an increase in the per cent of children responding correctly (alternative 2) without an accompanying decrease in the per cent of children responding to an asso-

TABLE 25
PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
Horizon, BY GRADES

| Alternatives | GRADES | | | |
|---|--------|------|------|------|
| | IV | V | VI | VII |
| The horizon means: | | | | |
| 1. The colors in the sky which can be seen just after the sun sets..... | 21.4 | 27.3 | 24.7 | 24.7 |
| 2. The line where the ground and the sky seem to meet..... | 16.3 | 43.4 | 50.5 | 58.8 |
| 3. The same thing as the ground..... | 1.0 | 1.0 | 0.0 | 1.0 |
| 4. The same thing as the sky..... | 3.1 | 0.0 | 0.0 | 1.0 |
| 5. I don't know..... | 56.1 | 24.2 | 20.6 | 8.2 |
| 6. I think it means..... | 1.0 | 2.0 | 2.1 | 4.1 |
| 7. Omitted..... | 1.0 | 2.0 | 2.1 | 2.1 |
| 8. Ambiguous..... | 0.0 | 0.0 | 0.0 | 0.0 |

ciated meaning. The retention of the associated meaning (alternative 1) does, however, limit the number of children who might otherwise have responded correctly.

Table 26 presents the per cents of children who responded to the alternatives offered with *prevailing winds*. *Prevailing winds* is a term which did not occur in the textbook material studied in Grades IV, V, and VI. For this reason the responses of the seventh-grade children only will be considered. Fewer children in Grade VII (11.3 per cent) responded to the correct definition (alternative 2) than to any of the incorrect definitions. The three incorrect alternatives describe characteristics which *prevailing winds* may have, and for this reason they are considered associated meanings. The possession of these associated meanings seems to be largely responsible for the small per cent of seventh-grade children who responded correctly to *prevailing winds*.

TABLE 26
PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
Prevailing Winds, BY GRADES

| Alternatives | GRADES | | | |
|---|--------|------|------|------|
| | IV | V | VI | VII |
| The prevailing winds of a country means: | | | | |
| 1. The winds which blow from the ocean to the land..... | 16.3 | 18.2 | 28.9 | 34.0 |
| 2. The winds which a country usually has..... | 14.4 | 4.0 | 8.2 | 11.3 |
| 3. Winds which are strong..... | 14.3 | 19.2 | 12.2 | 13.4 |
| 4. Winds which come from the west..... | 4.1 | 1.0 | 1.0 | 15.5 |
| 5. I don't know..... | 50.0 | 55.6 | 45.4 | 23.7 |
| 6. I think they mean..... | 0.0 | 1.0 | 0.0 | 0.0 |
| 7. Omitted..... | 0.0 | 1.0 | 4.1 | 1.0 |
| 8. Ambiguous..... | 1.0 | 0.0 | 0.0 | 1.0 |

The data presented in this section show: (1) that children tend to learn associated instead of basic meanings; and (2) that the per cent of children who respond correctly to a term is limited in part by the per cent who retain associated meanings. The conclusion then is that growth in understanding proceeds through a substitution of basic for associated meanings (Principle 3).

PRINCIPLE 4. GROWTH PROCEEDS THROUGH A DEVELOPMENT OF COMPREHENSIVE MEANINGS

According to the responses on the multiple choice test many meanings which children have for geographic terms are actually wrong, while others are incomplete. In one sense, of course, all meanings are incomplete since one can never know all there is to be known about anything. This is not the sense, however, in which the term "incomplete" is used here. By an "incomplete" meaning is meant a basic meaning which lacks the desired degree of comprehensiveness. The discussion which follows shows how incomplete meanings are related to growth in understanding.

Table 27 summarizes in per cents the responses of children to the alternatives offered with *trade*. The per cent of children who chose

TABLE 27
PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
Trade, BY GRADES

| Alternatives | GRADES | | | |
|----------------------------------|--------|------|------|------|
| | IV | V | VI | VII |
| <i>Trade</i> means: | | | | |
| 1. Raising crops..... | 0.0 | 0.0 | 0.0 | 0.0 |
| 2. Buying and selling goods..... | 78.6 | 85.9 | 80.4 | 89.7 |
| 3. Catching fish..... | 0.0 | 0.0 | 0.0 | 0.0 |
| 4. Building houses..... | 0.0 | 0.0 | 0.0 | 0.0 |
| 5. I don't know..... | 6.1 | 2.0 | 2.1 | 1.0 |
| 6. I think it means..... | 15.3 | 12.1 | 17.5 | 8.2 |
| 7. Omitted..... | 0.0 | 0.0 | 0.0 | 0.0 |
| 8. Ambiguous..... | 0.0 | 0.0 | 0.0 | 1.0 |

the correct alternative (alternative 2) for *trade* increased from 78.6 in Grade IV to 89.7 in Grade VII. It is evident from the other data of Table 27 that part of the increase in the per cents of children responding correctly was due to the decrease in the per cent responding with number-six answers.

An examination of the number-six answers for *trade*, not here reproduced, showed that most of the children had identified *trade* with

"barter." *Trade* does mean "barter," but it means much more than that. It is evident that the children who knew that *trade* meant "buying and selling goods" (alternative 2) had a much more comprehensive meaning of *trade* than did those who responded by defining *trade* as "barter." The increase in the per cent of children responding correctly to *trade* was plainly due to the fact that more comprehensive meanings of the term had been learned.

The per cents of children who responded to the alternatives offered with *rainfall* are found in Table 28. The data here are un-

TABLE 28
PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
Rainfall, BY GRADES

| Alternatives | GRADES | | | |
|--|--------|------|------|------|
| | IV | V | VI | VII |
| <i>Rainfall</i> means: | | | | |
| 1. The amount of rain which is necessary to raise crops. | 21.4 | 22.2 | 13.4 | 13.4 |
| 2. The amount of rain which soaks into the ground. | 14.3 | 9.1 | 7.2 | 13.4 |
| 3. The amount of sleet, snow, or rain which falls in a given length of time. | 8.2 | 4.0 | 7.2 | 5.2 |
| 4. The amount of rain which falls in a given length of time. . . | 32.7 | 39.4 | 50.5 | 51.5 |
| 5. I don't know. | 18.4 | 12.1 | 5.2 | 1.0 |
| 6. I think it means _____ | 4.1 | 12.1 | 15.5 | 12.4 |
| 7. Omitted. | 0.0 | 1.0 | 0.0 | 1.0 |
| 8. Ambiguous. | 1.0 | 0.0 | 1.0 | 2.1 |

usual in that, in all grades, the correct definition was the one most infrequently chosen. The correct definition of *rainfall* is "the amount of sleet, snow or rain which falls in a given length of time (alternative 3)." The per cents of children in Grades IV, V, VI, and VII who responded correctly were 8.2, 4.0, 7.2, and 5.2, respectively. The per cents of children who responded by choosing the alternative "the amount of rain which falls in a given length of time" were 32.7, 39.4, 50.5, and 51.5, respectively. The latter meaning of *rainfall* is not incorrect, but it is incomplete. In the case of *rainfall*, growth in understanding (as measured by alternative 3) did not occur for the reason that a comprehensive meaning of the term had not been developed.

Table 29 reports the per cents of children who responded to the alternatives offered with *altitude*. Altitude has two basic meanings—"height above the ground" and "height above the sea." In these two meanings of *altitude*, offered as alternatives 1 and 2, the per cents of children who chose each did not vary markedly from grade to grade. The per cent of children who responded to the comprehensive mean-

TABLE 29*

PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
Altitude, BY GRADES

| Alternatives | GRADES | | | |
|---|-----------------|----------------|-----------------|------------------|
| | IV (N = 100) | V (N = 100) | VI (N = 100) | VII (N = 100) |
| <i>Altitude</i> means: | | | | |
| 1. Height above the ground..... | 14 | 4 | 14 | 16 |
| 2. Height above the sea..... | 6 | 6 | 13 | 9 |
| 3. Sometimes height above the ground and some- times height above the sea..... | 15 | 31 | 48 | 47 |
| 4. Height of a building..... | 12 | 3 | 2 | 1 |
| 5. I don't know..... | 50 | 49 | 16 | 18 |
| 6. I think it means..... | 1 | 7 | 5 | 9 |
| 7. Omitted..... | 2 | 0 | 0 | 0 |
| 8. Ambiguous..... | 0 | 0 | 2 | 0 |

*Data derived from supplementary multiple choice test.

ing of *altitude* (alternative 3) increased from 15 in Grade IV to 47 in Grade VII. The increase in the per cent of children who responded correctly was accompanied by a corresponding decrease in the per cent of children who admitted that they did not know the meaning of *altitude* (alternative 5).

These two facts might be interpreted to mean that most children, when they learn the meaning of *altitude*, learn both of its meanings. One might just as reasonably, however, interpret the facts to mean that the decrease in the per cent of children who responded with "I don't know" (alternative 5) was due to the fact that the children had learned *one* of the two basic meanings of *altitude* and that the increase in the per cent of children who responded correctly (alternative 3) was due to the development of a comprehensive meaning on the part of some of the children who had formerly known only one of the two basic meanings. Perhaps both interpretations are needed to account for the facts.

The per cents of children who responded to the alternatives offered with *deposit* are given in Table 30. Of the three incorrect meanings for *deposit* (alternatives 1, 3, and 4) "coal" was the only one to which in any grade more than four per cent of the children responded. "Coal" may legitimately be thought of as an incomplete meaning of *deposit*. The per cent of children who chose this alternative, an incomplete meaning, for *deposit* decreased from 43 in Grade IV to 9 in Grade VII.

Since, with respect to the per cents for items 3, 4, 5, 6, 7, and 8, the sums of the decrements at successive grade levels were small in

TABLE 30*
PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
Deposit, BY GRADES

| Alternatives | GRADES | | | |
|---|--------|----|----|-----|
| | IV | V | VI | VII |
| A deposit means an underground supply of: | | | | |
| 1. Coal..... | 43 | 26 | 21 | 9 |
| 2. Any material..... | 22 | 40 | 41 | 65 |
| 3. Iron..... | 4 | 3 | 2 | 1 |
| 4. Copper..... | 3 | 0 | 3 | 0 |
| 5. I don't know..... | 23 | 20 | 17 | 17 |
| 6. I think it means..... | 2 | 9 | 14 | 6 |
| 7. Omitted..... | 2 | 2 | 1 | 1 |
| 8. Ambiguous..... | 1 | 0 | 1 | 1 |

*Data derived from supplementary multiple choice test. As in the case of Table 29 and of Table 31, to follow, 100 test papers per grade were used in this analysis.

comparison with the corresponding increments for alternative 2, one may safely infer that the increase in the per cent of children who responded correctly to *deposit* by selecting the comprehensive meaning "Any material" was due in large measure to the decrease in the per cent of children who chose the incomplete meaning "Coal."

The data with regard to *communication* are given in Table 31. In all grades the incorrect alternative most frequently chosen was "They talk with each other" (alternative 1). The per cent of children who had this meaning for *communication* decreased from 38 in Grade IV to 17 in Grade VII. In no grade did more than 8 per cent of the children choose either of the other two incorrect alternatives. From Grade IV to Grade VII the per cent of children who responded correctly (alternative 4, "They have some way of exchanging information")

TABLE 31*
PER CENTS OF CHILDREN WHO RESPONDED TO ALTERNATIVES OFFERED WITH
Communication, BY GRADES

| Alternatives | GRADES | | | |
|---|--------|----|----|-----|
| | IV | V | VI | VII |
| If people have communication with each other, that means: | | | | |
| 1. They talk with each other..... | 38 | 29 | 31 | 17 |
| 2. They write letters to each other..... | 6 | 4 | 3 | 1 |
| 3. They telephone each other..... | 8 | 4 | 6 | 3 |
| 4. They have some way of exchanging information..... | 13 | 17 | 46 | 70 |
| 5. I don't know..... | 33 | 42 | 6 | 8 |
| 6. I think it means..... | 1 | 3 | 5 | 1 |
| 7. Omitted..... | 1 | 1 | 2 | 0 |
| 8. Ambiguous..... | 0 | 0 | 1 | 0 |

*Data derived from supplementary multiple choice test.

tion") increased from 13 to 70, a difference of 57 points. At the same time the decrease in the per cent of children who admitted that they did not know the meaning of *communication* (alternative 1) amounted to only 25 points (33-8). It is apparent from these facts that the increasing per cent of children who responded correctly to *communication* was caused not only by a decrease in the per cent of children who did not have a meaning for the term but also by an increase in the per cent of children who abandoned an incomplete meaning (alternative 1) in favor of a more comprehensive one (alternative 4).

The data which have been presented in Tables 27, 28, 29, 30, and 31 are interpreted to mean that growth in understanding proceeds through the development of comprehensive meanings (Principle 4).

PRINCIPLE 5. GROWTH PROCEEDS THROUGH A REDUCTION OF ERRORS

The answers in the various test blanks revealed a great many other incorrect responses than those already discussed. In spite of the fact that the subjects had been told not to guess, it is probable that many of the mistakes do represent random choices rather than misconceptions. Some of the incorrect responses, however, were made by such relatively high per cents of the children that guessing cannot be considered the determining factor. An analysis of these incorrect responses discloses several types of error in addition to those comprehended under the five principles of growth already treated. Four types of error will be discussed, namely: (1) errors due to a confusion of terms having similar sounds, (2) errors due to a confusion of positions, (3) errors due to an application of old meanings, and (4) errors due to "other causes."

1. Errors Due to a Confusion of Terms Having Similar Sounds.

The responses made on the multiple choice test seem to indicate that *navigation* was confused with *cultivation*. One of the definitions of *navigation* was "raising crops." The per cents of children in Grades IV, V, VI, and VII who selected this definition were 12.2, 33.3, 29.9, and 17.5. In only one case did as many as 4.1 per cent of the children in any grade select either of the two remaining incorrect definitions.

Export and *import* were confused. From 19.4 to 17.5 per cent of the children in all grades responded to *import* by selecting the definition for *export*. With respect to the children in Grade IV, and per-

happens those in Grade V, the selection of the definition for *export* may have been largely a matter of chance. In the case of the children in Grades VI and VII, on the other hand, the selection could not have been so determined. In the first of these grades the per cent of children who responded correctly to *import* was 82.5 and the per cent who responded by selecting the definition of *export* was 15.5. In Grade VII the corresponding per cents were 78.4 and 17.5. The data on *export* reveal that some children in all grades confuse *export* with *import*, but the per cents of children who do so are not as great as the per cents who confuse *import* with *export*.

Latitude and *longitude* are confused. From 14 to 34 per cent of the children in all grades responded on the multiple choice test to *latitude* by selecting the definition of *longitude*. From 20 to 30 per cent of the children in all grades responded to *longitude* by selecting the definition of *latitude*. That these per cents are not to be accounted for in terms of chance was shown by the per cents of children who selected for both words definitions other than the ones mentioned.

2. Errors Due to Confusion of Positions.

On the identification test, *antarctic circle*, *arctic circle*, *meridian*, *tropic of Cancer*, and *tropic of Capricorn* were frequently identified with *parallel*. Table 32 contains the per cents of children who identified as *parallel* each of the terms mentioned. The per cents for *parallel*

TABLE 32

PER CENTS OF CHILDREN WHO IDENTIFIED *Antarctic Circle*, *Arctic Circle*, *Meridian*, *Tropic of Cancer*, AND *Tropic of Capricorn* AS *Parallel*, BY GRADES

| Terms | GRADES | | | |
|--------------------------|----------------|---------------|----------------|-----------------|
| | IV (N = 98) | V (N = 99) | VI (N = 97) | VII (N = 97) |
| Antarctic circle..... | 30 | 16 | 21 | 13 |
| Arctic circle..... | 32 | 19 | 19 | 12 |
| Meridian..... | 1 | 7 | 5 | 10 |
| Tropic of Cancer..... | 19 | 12 | 13 | 6 |
| Tropic of Capricorn..... | 14 | 12 | 2 | 9 |
| Parallel..... | 17 | 19 | 36 | 42 |

are included in the table for purposes of comparison. While the terms listed in Table 32 were frequently identified as *parallel*, only infrequently was *parallel* in turn identified with any of the terms referred to except *meridian*. The per cents of children in Grades IV, V, VI, and VII who identified *parallel* as *meridian* were 14, 28, 28, and 29, respectively.

North pole was frequently identified with *arctic circle* and *south pole* with *antarctic circle*, the per cents in each case ranging from approximately 29 in Grade IV to 10 in Grade VII. *Arctic circle* and *antarctic circle* were only infrequently identified respectively as *north pole* and *south pole*.

In considering the magnitudes of the per cents cited in the foregoing section, one should bear in mind the fact that *twenty* letters, in addition to the three used in the pretests, occurred on the maps. On the basis of pure chance one should expect a term to be identified correctly only 5 per cent of the time.

3. Errors Due to An Application of Old Meanings.

Many of the incorrect meanings which children have for geographic terms result from applying old meanings to new situations. For a country to have a *heavy rainfall* means to many children that the country has *hard* rains. In ordinary parlance a *hard* rain is frequently described as a *heavy* rain, and this fact doubtless accounts, in part at least, for the belief that *heavy rainfall* and *hard rains* are synonymous expressions.

To many children a *coal field* does not mean "a large section of the country where coal is found." To them *coal field* means an ordinary field that has coal on it or in it. The per cents of children in Grades IV, V, VI, and VII who chose the alternative "a place several acres big where coal is found" were 11.2, 24.4, 22.7, and 23.7, respectively. The evidence that many children make this error is not, however, limited to the data of the multiple choice test; similar evidence was derived from personal interviews.

Approximately 50 per cent of both sixth- and seventh-grade children know that *mainland* means "The large body of land, not the islands," but some of them seemed to arrive at the meaning by inference from the meaning of *main*. Consequently, the meaning of *mainland* was sometimes distorted. According to one child, a peninsula could not be the *mainland* because "it was not the main part."

Many children showed uncertainty on the concrete material test when asked to locate a *basin*. Even when the *basin* was pointed out correctly there was frequently a hesitation in the movement of the hand. The remarks of the subjects showed that the *basin* on the model did not fit their concepts very well. "A *basin* is like a basin of water" seemed to be the idea of many of the subjects. On the multiple choice test, over 20 per cent of the children in each of Grades IV, V, and VI and 15 per cent in Grade VII selected the alternative "a pond

of water" as the meaning of *basin*. In only one case did more than 7 per cent of the children select either of the other two incorrect definitions.

As shown by data from multiple choice tests, approximately half of the children in all grades thought that if a city is a *center* it is because the city is in the middle of a district. The term *center* was introduced as, "If a city is a *center* that means," and the correct definition was, "The city is famous for some important work." The per cents of children in Grades IV, V, VI, and VII who selected this meaning were 11.2, 27.3, 38.1, and 38.1, respectively. The corresponding per cents who responded to the alternative, "The city is in the middle of a district," were 57.1, 50.5, 52.6, and 46.4.

4. *Errors Due to "Other Causes."*

Under this heading are included several errors of a miscellaneous kind. Twenty-three per cent of the seventh-grade children indicated on the multiple choice test that they thought iron *deposits* meant "things which are made of iron." Apparently *deposits* was confused with *products*. Thirty-eight per cent of the seventh-grade children failed to respond correctly to *area*. Over half of these indicated that they thought that the *area* of a country was the distance around it. Many children confuse the *mouth* of a river with its *source*, but some children who say that "the mouth of a river is the place where the river starts" mean, for example, that as one approaches a river from the ocean, the river is first encountered at its mouth.³

To summarize, the data presented in this section indicate that growth in understanding proceeds through a reduction of errors, of which important types are those due to: (1) confusion of terms having similar sounds, (2) confusion of positions, (3) application of old meanings to new situations, and (4) "other causes" (Principle 5).

³ In the foregoing section, errors involving twenty-one terms used in the investigation have been reported. Of the twenty-one terms referred to, fourteen occur in Part I of the multiple choice test, two in Part II, and five in Part III. The reader is reminded of the fact that the part of the multiple choice test in which a term appeared was determined on the basis of "frequency of occurrence" in textbook material studied (see Chapter II, Section of Terms, p. 20). The significance of an error depends on the opportunity which a pupil has had to learn the meaning of the term involved. This fact has been kept in mind throughout the discussion of the errors, and due care has been exercised in the presentation of the data.

CHAPTER V

SUMMARY AND CONCLUSIONS

RÉSUMÉ

The problem of this study was chosen in the hope of arriving at a better understanding of the mental processes of children in acquiring geographic meanings. Stated briefly, the problem is, "How does growth in understanding of geographic terms proceed among the children of the elementary school, in grades four to seven?" Five types of test were used in the course of the investigation: (1) essay, (2) multiple choice (two tests), (3) identification, (4) intelligence, and (5) concrete materials. These tests were administered to approximately eight hundred children in the public schools of Greenwood, South Carolina.

The collected data indicate that it is impossible to represent growth in understanding adequately by means of single curves and graphs. Growth is a complex function, or set of functions, and its course is determined by a number of factors. The data of this investigation permitted treatment of six such factors, namely: (1 and 2) amount and kind of experience, (3) level of geographic attainment, (4) manner of verbalization, (5) mental age, and (6) sex.

While the nature of the changes which take place when growth in understanding occurs cannot be adequately represented by means of curves and graphs, they can be at least partly described in terms of principles. Five principles of growth have been derived and treated. These principles may be stated as follows:

1. Growth in understanding proceeds through an increase in the number of different kinds of meanings.
2. Growth in understanding proceeds through an increase of general information.
3. Growth in understanding proceeds through a substitution of basic for associated meanings.
4. Growth in understanding proceeds through a development of comprehensive meanings.
5. Growth in understanding proceeds through a reduction of errors; important types are those due to: (a) confusion of terms having similar sounds, (b) confusion of positions, (c) application of old meanings to new situations, and (d) "other causes."

LIMITATIONS OF STUDY

The most serious *apparent* limitation of this investigation is the fact that the data were restricted to a single school system. The reader may feel that if the tests had been given in several school systems the results obtained would have been more *reliable*. To have given the tests in several school systems would have resulted in the testing of a greater number of children, it is true, and, consequently, in a greater "reliability" of the data. The writer, however, considers that his data *are* reliable. Approximately 100 children in each of Grades IV, V, VI, and VII were tested on the group tests and, had the writer felt that a greater number of cases were needed for purposes of "reliability," a larger sample would have been taken. The word *apparent* has been emphasized because the writer feels that the limitation which has been discussed is not a real one. If the tests *had* been given in several school systems, the data could have been thrown together and treated *en masse* only if the systems were closely similar.

Averages and other statistical measures based on data secured from a wide variety of sources are more desirable for some purposes than for others. For the purposes of this investigation they were not essential: such gross data do just what they are intended to do, namely, iron out characteristic differences. In this study, it was these characteristic differences which were wanted because such differences show *trends*. If the data used in this investigation had been secured from *dissimilar* school systems, it is possible that many of the trends would have been obscured.

A second limitation, somewhat related to the first one and likewise apparent rather than real, relates to the "universality" of the results obtained. The fact that children in different sections of the country have different experiences with terms may lead the reader to question whether the factors and principles which have been derived are universally valid. The answer to such a question is that the validity of the factors and principles is independent of the vagaries of responses to particular terms. If investigations similar to this one were conducted in different sections of the country the writer believes that the same *kinds* of data would be obtained, although the children's responses to some of the terms probably would be very different. If this assumption is valid, then the factors and principles derived from data obtained elsewhere would be the same as those derived in the present investigation.

SIGNIFICANCE OF STUDY

Effective reading, more than any other academic factor, conditions a child's ability to do his school work successfully. To read effectively requires understanding. Words are but symbols to which meanings must be attached if there is to be understanding. Meanings are more than sounds. It is possible for a child to "read" perfectly, in the sense that he can make all necessary movements of the mouth and vocal cords either implicitly or overtly, even if he does not understand in the least the meaning of the passage which he reads. Meanings are adjustments which are dependent upon experience. It follows, then, that if children are to understand geography they must have experiences with the vocabulary of geography. One of the responsibilities of the geography teacher is to see to it that the experiences of her pupils are adequate for the development of meanings.

The factors and principles which have been summarized in this investigation are of significance to teachers who plan for the experiences of their pupils. Several ways in which they are significant will be pointed out briefly.

Varied experiences. An adequate understanding of a term means that it is known in a number of different ways and that it is associated with many ideas. Terms cannot be known in a number of different ways, however, unless they are experienced in a variety of situations. It follows then that if adequate meanings are to develop, pupils must have the advantages of a rich and varied set of experiences.

These experiences cannot be provided for merely through an elaboration of textbook procedures. Words about things are not sufficient, because words do not initiate the necessary first-hand experiences. In order to provide for these experiences, much more of the concrete must be introduced into instruction. By means of field trips, manual activities, and demonstrations many terms can be made to take on meaningful significance which they otherwise would not have.

Right experiences. As was pointed out in the discussion of "Principle 2. Growth Proceeds through a Substitution of Basic for Associated Meanings" (p. 46) an associated meaning of a term is often learned as basic. Such a condition seems to be the result either of the child's reacting to an *irrelevant* part of the situation or of his *peculiar* way of interpreting the meaning of a sentence. Examples will serve to clarify this statement. Suppose a child who does not

know the meaning of *horizon* hears someone who is admiring a beautiful sunset remark, "Just look at the horizon! Isn't it beautiful?" The question to the child is, "What is the *horizon*?" Under the circumstances he can hardly give but the one answer, namely, "the colors." And so the child learns that the horizon means "the colors which are seen in the sky when the sun sets." The colors are the one aspect of the situation to which the child reacts. The colors are, however, an *irrelevant* part of the situation so far as the true meaning of *horizon* is concerned. The relevant part is "the line where the sky seems to meet the earth."

Prevailing winds is an example of a term for which the associated meanings seem to be the result of a peculiar way of interpreting the meaning of a sentence. Suppose the textbook says, "Here the prevailing winds blow from the ocean." Some children apparently identify the subject of the sentence with the predicate and thus *prevailing winds* comes to mean "winds which blow from the ocean."

The fact that associated meanings may be learned in place of basic meanings is important for theories of teaching. When a child experiences he learns, but the point is that children do not always have the experiences which their teachers think that they have. The consequence is that children often develop erroneous meanings of which their teachers are quite unaware. If children are to develop correct meanings, care must be exercised and precautions taken to see to it that they have the *right* experiences.

Negative transfer. One of the cardinal principles of instruction is that the *old* should be made use of in teaching the *new*. It is expected that such instruction will result in positive transfer and thus facilitate learning. Unfortunately negative transfer as well as positive transfer may occur, and learning, instead of being facilitated, may be impeded. Such terms as *belt*, *center*, *deposits*, *coal field*, *headwaters*, *highland*, *lowlands*, *mainland*, *raw material*, and *possessions* may be easily misunderstood. Each of these terms, either in whole or in part, has nongeographic meanings probably formed before the study of geography. Special care is required to see that negative transfer does not occur.

Planned instruction. The facts which have been brought out in this investigation emphasize the need for more carefully planned instruction in geographic vocabulary. Incidental instruction is not sufficient. Well-planned instruction should be based on two considerations: (1) effective presentation of material and (2) amount and kind of material.

With respect to (1) *effective presentation*, the point should be emphasized that "the best method of presentation" of geographic terms cannot be determined from a set of rules and formulae. The method of presentation which is superior in one situation may be distinctly inferior in another. The effectiveness of teaching procedures is in turn conditioned (a) by aims, both immediate and remote; (b) by the nature of the learner, that is, his interests, past experiences, and mental capacity; and (c) by individual differences in teachers.

With respect to (2) *amount and kind of material*, two questions are involved: (a) Does the child have the mental maturity requisite to learn the meanings of the terms? (b) Is it *desirable* that he learn the meanings of the terms? It does not follow that because terms can be taught at a given stage of a child's development they should be taught at that time.

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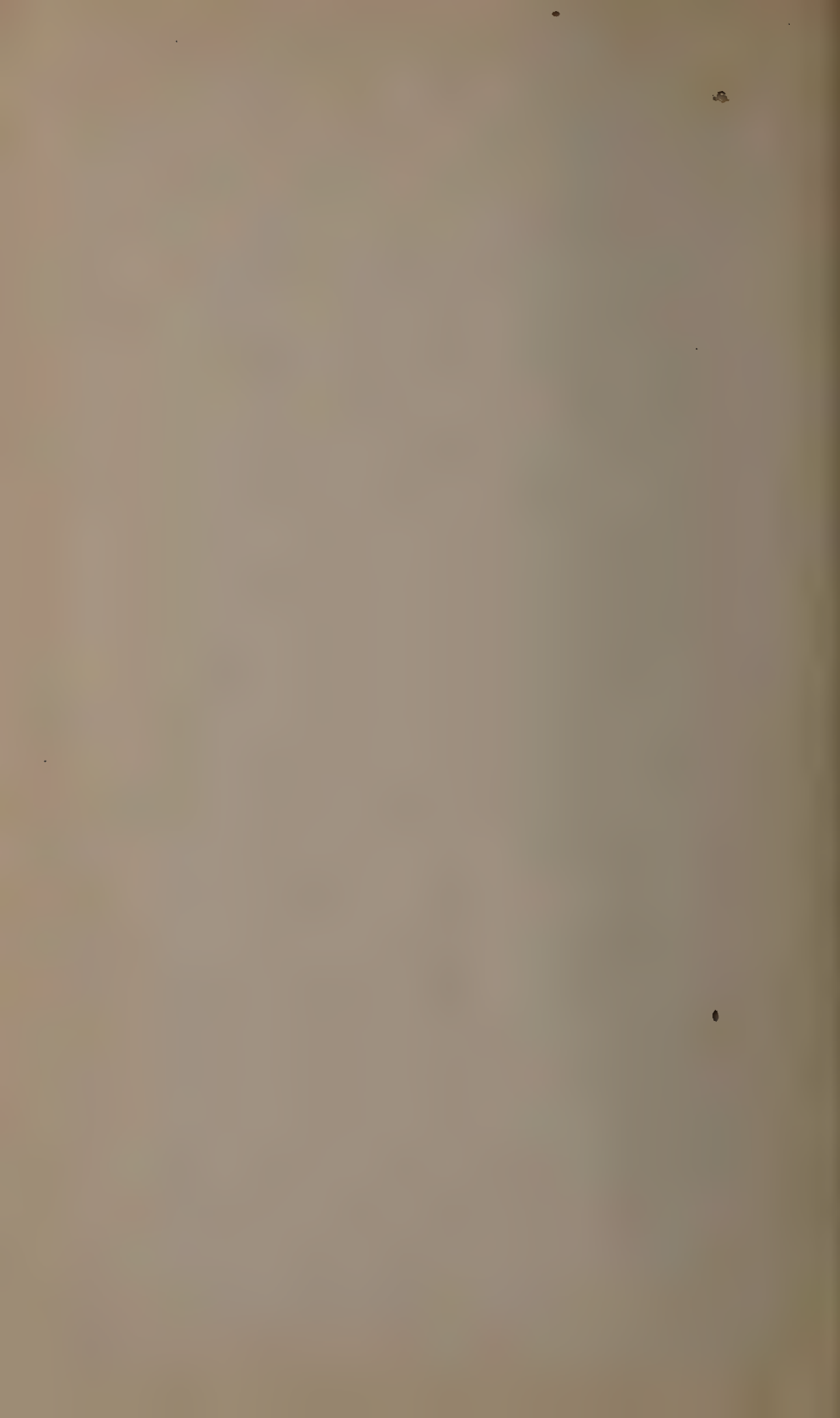
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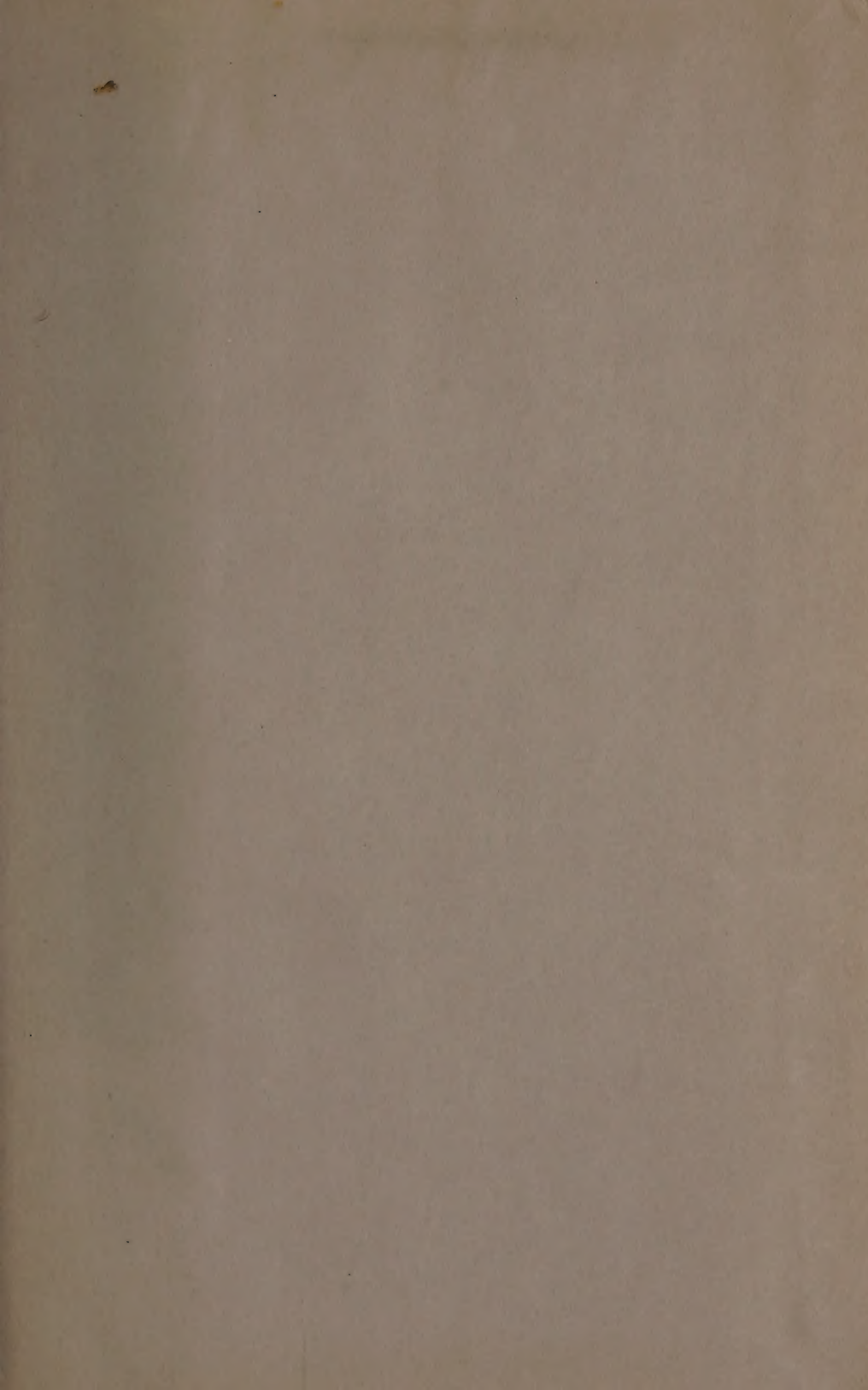
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